foreword

This soil survey contains information that can be used in land-planning programs in Stevens County, Washington. It contains predictions of soil behavior for selected laid uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many offer soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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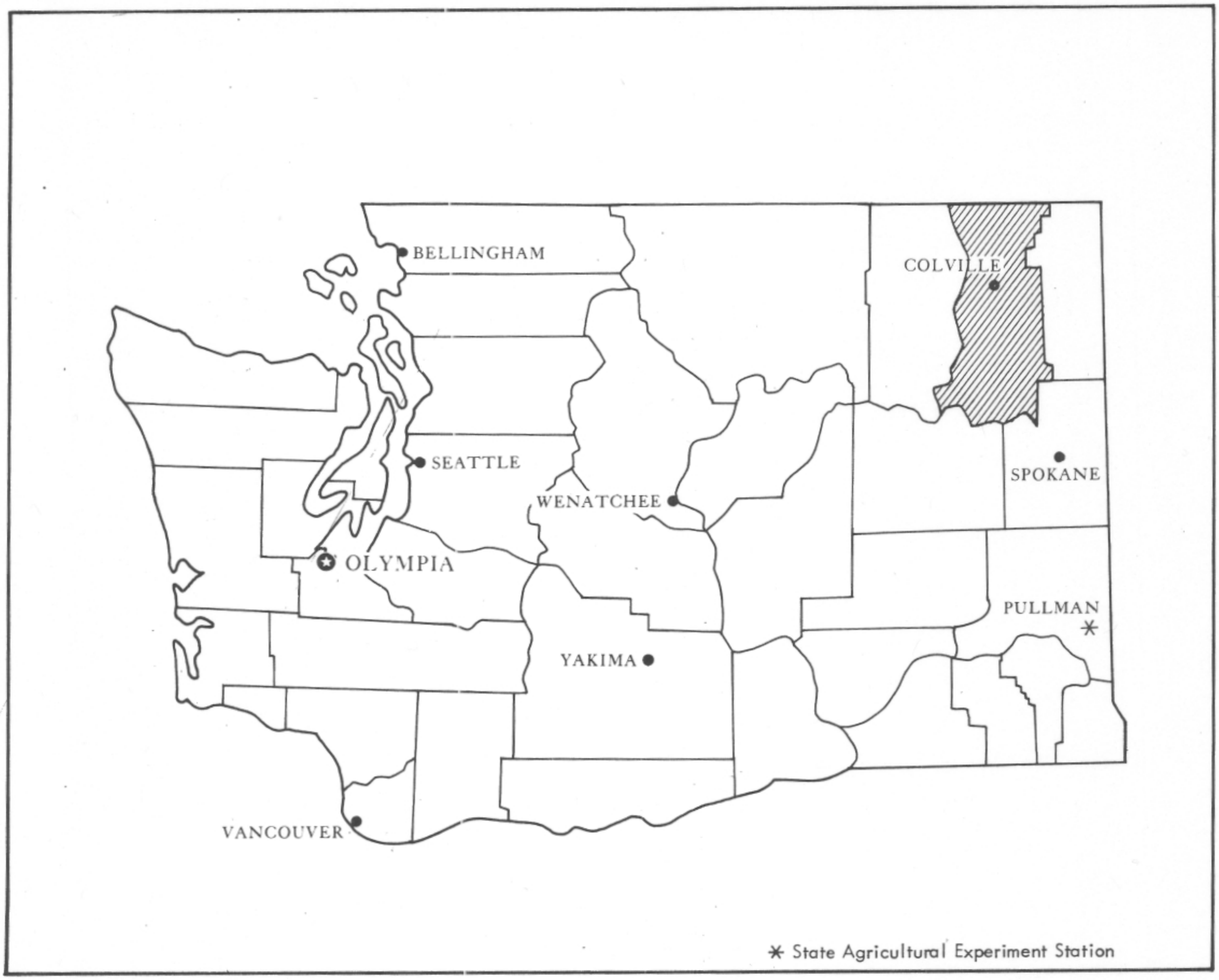

Location of Stevens County in Washington.

soil survey of
Stevens County, Washington

By Norman C. Donaldson and Joseph T. DeFrancesco
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Soils surveyed by Norman C. Donaldson, Marvin E. Haagen, and Joseph T. DeFrancesco, Soil Conservation Service Don W. Barron and Robert L. Evans Washington State Department of Natural Resources Robert A. Klink, Forest Service, and
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Woodland fieldwork by Larmie D. Edwards Washington State Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service in cooperation with Forest Service
United States Department of the Interior, Bureau of Indian Affairs
Washington State Department of Natural Resources and Washington State University, Agricultural Research Center

Stevens County is in the northeastern part of Washington. It has an area of about 2,481 square miles, or 1,587,970 acres. The population is approximately 22,708. Colville, the county seat, is near the center of the county.

Stevens County is bounded on the west by the Columbia and Kettle Rivers, on the south by the Spokane River, on the north by Canada, and on the east by Pend Oreille and Spokane Counties. It ranges from 26 to 35 miles in width and is about 80 miles in length.

Soil scientists have identified about 70 different kinds of soils in Stevens County. The soils have a wide range in texture, natural drainage, and other characteristics. The soils along the major drainageways are suited to cropland, hay, and pasture. Wetness is the main limitation. The soils on outwash terraces are suited to cropland, pasture, and woodland. The low available water capacity is the main limitation. Upland soils are suited to cropland, hay and pasture, woodland, recreation, grazed woodland, and wildlife habitat. They have few limitations. The soils on mountains are suited to woodland, grazed woodland, recreation, and wildlife habitat. The main limitation is slope.

general nature of the survey area

history and development

Stevens County was established by the Legislature of the Territory on January 20, 1863, and was organized from the northwestern part of Walla Walla County. The county was named in honor of Isaac I. Stevens, the first Territorial Governor of Washington.

The boundaries of Stevens County have undergone more major changes than any county in the State. Spokane, Whitman, Okanogan, Ferry, and Pend Oreille Counties were formed from Stevens County. The final boundaries of Stevens County were set in 1911.

Major holders or managers of land in Stevens County are United States Department of Agriculture, Forest Service; Department of the Interior, Fish and Wildlife

Service, Bureau of Land Management, and Bureau of Reclamation; and the Spokane Indian Tribe. Other lands are privately owned.

Farming is one of the main economic enterprises in the county. The climate is favorable for cash-grain and hay crops, for livestock raising, and for orchards. Forestry also is a major economic enterprise. Several large lumber mills and many small mills are located throughout the county. In 1977, about 145,300 million board feet of lumber was cut in Stevens County. In addition, several mining and processing industries associated with minerals are operated in the county. Finally, recreation is a major contributor to the economy.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In Stevens County, summers are warm or hot in most valleys and much cooler in the mountains. Winters are cold in the mountains. Valleys are colder than lower slopes of the adjacent mountains because of cold air drainage. In the mountains, precipitation occurs throughout the year, and a deep snowpack accumulates during winter. Snowmelt generally supplies much more water than can be used for farming in the area. In the valleys, precipitation in summer falls as showers, although some thunderstorms occur. The ground is covered with snow much of the time in winter. However, warm and dry chinook winds blow downslope and often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Colville, Washington, in the period 1951 to 1976.

In winter the average temperature is 28 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Colville on December 30, 1968, is -33 degrees. In summer the average temperature is 65 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred at Colville on July 18, 1960, is 107 degrees.

Of the total annual precipitation, 7 inches, or 40 percent, generally falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 6 inches. The heaviest 1-day rainfall during the period of record was 1.44 inches at Colville on January 7, 1962. Thunderstorms occur on about 10 days each year, and most occur in summer.

Average seasonal snowfall is 47 inches. The greatest snow depth at any one time during the period of record was 34 inches. On an average of 38 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in April.

physiography, relief, and drainage

Stevens County comprises six general physiographic divisions. They are the Columbia-Kettle River Valley, the Colville-Chamokane Valley, the Spokane River Valley, the Spokane Plateau, the Calispell Mountain Range, and the Huckleberry Mountain Range.

The Columbia-Kettle River Valley is a narrow mountain valley in the northwestern part of the county. The Columbia River flows across the valley to the county boundary at the village of Marcus. The Kettle River flows south from the Canadian border, forming the western boundary of the county. Near Marcus, it joins the Columbia River, and from that junction, the Columbia River continues south, forming the western boundary of Stevens County.

The floor of the Columbia Valley is narrow in some places and irregular in shape and width in other places. The river flood plain is not clearly defined. The alluvial deposits and terraces range from a quarter of a mile or less to 3 miles in width.

The sidewalls of the valley rise steeply but rarely precipitously to the mountains. These sidewalls are that part of the mountain slopes that have been scoured by intense glacial abrasion. Exposures of bedrock are unweathered and appear smoothed and rounded. Similarly shaped knolls and ridges have been buried by river terraces. In some places, these terraces seem to be remnants of deposits from quiet water, and in other places, they seem to have been deposited by running water. The cross section of the Columbia Valley resembles a wide open V that is rounded at the bottom.

Within a few miles of the valley, the mountains rise several thousand feet above the Columbia River. Elevation of the river is about 1,349 feet at the international boundary line; 1,290 feet at Marcus; and about 1,290 feet at the junction of the Columbia and Spokane Rivers.

Grand Coulee Dam now backs water as far as the Canadian line. The backwater level of Roosevelt Lake fluctuates as a result of seasonal drawdown, which is controlled by Coulee Dam. The lake is over 100 miles in length.

The Kettle River Valley enters the United States at the northwestern corner of Stevens County and follows a general southerly direction for about 27 miles. It joins the Columbia River near Marcus. The Kettle River is narrow and deep, and the water flows swiftly. Terraces range from 1/4 mile to 1 1/2 miles in width and are not so high above the river as the terraces above the Columbia and Spokane River Valleys. Within a few miles of the river, the mountains rise abruptly to an elevation of 4,000 to 5,000 feet.

The Colville-Chamokane Valley extends northward from the Spokane River in the southern pact of the county to beyond Colville, which is more than halfway between the southern and northern boundaries of the county. From Colville, the valley turns northwestward and joins the Columbia Valley near Meyers Falls. Two miles north of Colville, the valley branches, and the smaller valley extends farther northward and opens into the Columbia Valley a few miles northeast of Marcus. Other shorter and narrower branch or loop valleys are in the same area. The floors of all of these valleys are accordant with the floor of the Colville-Chamokane Valley, which is about 1,700 feet above sea level in the southern part of the county, and 1,550 feet in elevation at Colville. The elevation of the Columbia River, however, is about 250 feet less. It is 1,300 feet above sea level at Kettle Falls, which is the point nearest to Colville.

The Colville-Chamokane Valley is flat bottomed and ranges from 1 mile to 3 miles in width. The valley floor is made up of water-laid deposits of considerable thickness throughout its entire length. The sides of the valley slope gradually and appear as the weathered slops of an aggrading stream or of a youthful stream that is actively eroding its valley.

One of the most conspicuous topographic features in the central part of Stevens County is Old Dominion Mountain about 7 miles east of Colville. It has an elevation of 5,774 feet. Other lofty ridges and peaks in the same area are Old Douglas Mountain, which is northeast of Colville, and Addy Mountain, which is east of the town of Addy. Old Douglas Mountain has an elevation of 5,245 feet, and Addy Mountain has an elevation of 4,885 feet. These mountains are isolated from the main ranges by minor stream valleys.

The Spokane River Valley winds in a general eastwest direction. It follows the southern border of the county for about 50 miles. River terraces in the Spokane Valley range from 1/4 mile to 1 1/2 miles in width and are at an elevation of 50 to 500 feet. The Spokane River marks the boundary between the Okanogan Highlands to the north and the Spokane Plateau in central Washington to the south. In places the rocky slopes of the mountains extend nearly to the river. In other places perpendicular bluffs of water-laid material border the river. Behind the bluffs lies rolling to hilly country that merges into the Huckleberry and Calispell Mountain Ranges. Much of this area, which is drained by the Spokane River, is rolling. It is less hilly and broken than similar areas.

The Spokane Plateau is included in the Spokane and Colville drainage basins. It is a remnant of a basaltic tongue that projected up an old valley from the Columbia Plains. The largest unbroken area lies west and southwest of the town of Springdale. Remnants are on each side of the Colville-Chamokane Valley, extending as far north as the village of Valley on the north side to within 5 miles of the town of Chewelah on the east side. These remnants were probably once connected with each other and with the large area southwest of Springdale, as well as with the main plain south of the Spokane River. The Spokane Plateau is characterized by an undulating surface that is broken by perpendicular bluffs of basalt facing the stream courses. In places, basaltic rock is on the north side of the Spokane River between the Columbia River and the eastern boundary of Stevens County.

The Calispell Mountain Range forms the divide between the Colville-Columbia and the Pend Oreille drainage systems. Prominent topographic features are Calispell Peak, a short distance east of the county line, which has an elevation of 6,837 feet; and Chewelah Mountain, which has an elevation of 5,743 feet. The average elevation of the divide ranges from 5,000 to 5,500 feet. The crest of the divide follows a sinuous line that crosses and recrosses the eastern boundary of the county several times. The western slope of the divide, lying almost wholly within Stevens County, is traversed by numerous lateral streams that rise far up the mountainside, flow in deep V-shaped valleys, and have narrow, rocky divides among them.

The range as a whole is considered to be mainly composed of metamorphic rock. In places, the hilly divides between tributaries of the Colville River merge gradually into the mountainous regions. In other places, there is a marked line of demarcation between them. A spur of the main divide extends southwest from Deer and Loon Lakes and is separated from the main range by a pass at the south end of Loon Lake at an elevation of about 2,400 feet. This spur reaches an elevation of 4,000 feet. It is composed of granite and has a less jagged outline than the main range.

The Huckleberry Range extends from the Canadian border to the Spokane River. The continuity of the range is broken by the Columbia and Colville River Valleys. The southern division forms the divide between the drainage systems of the Columbia and Colville Rivers and is a distinctive topographic feature of Stevens County. This divide attains elevations ranging from 3,200 to 6,200 feet, with an average of about 4,500 feet. Stensger Peak, about 12 miles west of the village of Valley, is the highest point. It is 5,819 feet above sea level. Other high peaks are Dunn and Monumental Mountains. They have elevations of 5,340 and 5,532 feet, respectively. Several roads cross the range at elevations of 3,200 and 4,200 feet. Slopes are steep and rocky, and ridges are often sharp and narrow.

The Huckleberry Range varies in width from 2 to 7 miles. It is widest in the southern part. The descent on the Columbia River side is shorter and steeper than that on the Colville River side. The Columbia River ranges from 400 to 500 feet lower than the Colville River. There is very little farmland in the higher and rougher parts of this range. The triangular area south of the international boundary between the Kettle and Columbia Rivers is a continuation of the Huckleberry Range. This area forms the watershed between the rivers. The range, which has a lofty and rugged character in the northern part of the county, is mainly included in the Colville National Forest.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries; accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soils on mountains

This group consists of two map units. It makes up about 21 percent of the survey area. The soils in this group range from nearly level to very steep. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation ranges from 1,800 to 6,000 feet. Average annual precipitation ranges from 16 to 45 inches, average annual air temperature ranges from 43° to 47° F, and the average frost-free season ranges from 70 to 130 days. These soils are moderately deep and well drained. They formed in material weathered from granite or shay rock, with an admixture or mantle of volcanic ash and loess.

This group of soils is mainly used for grazeazble woodland. Some areas are used for recreation, watersheds, wildlife habitat, or homesite development. Small areas may be used for nonirrigated cropland.

1 Spokane-Moscow-Rock outcrop

Moderately deep, well drained, nearly level to very steep soils formed in material weathered from granite, with an admixture of loess and volcanic ash, and Rook outcrop; on mountains

This map unit is in granitic areas, mainly in the southern and eastern part of the county. Spokane soils are mainly on southern exposures, and Moscow soils are mainly on northern exposures. This unit is characterized by rounded ridgetops and smooth mountain toe slopes, foot slopes, and side slopes. Drainageways are deeply dissected. Slope ranges from 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation ranges from 1,800 to 4,000 feet. Average annual precipitation ranges from 16 to 35 inches, average annual air temperature ranges from 43° to 47° F, and the average frost-free season ranges from 80 to 130 days.

This map unit makes up about 8 percent of the survey area. It is about 40 percent Spokane soils, 30 percent Moscow soils, 15 percent Rock outcrop, and 15 percent soils of minor extent.

The Spokane soils are mainly on south-facing slopes and ridgetops. These soils formed in residuum weathered from granite, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The surface layer is loam. The subsoil is gravelly sandy loam. The substratum is gravelly sandy loam over weathered granite at a depth of about 26 inches. Depth to weathered granite ranges from 20 to 40 inches.

The Moscow soils are mainly on north-facing slopes. These soils formed in residuum weathered from granite, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The subsurface layer is very fine sandy loam. The upper part of the subsoil is silt loam, and the lower part of the subsoil is sandy loam over weathered granite at a depth of about 26 inches. Depth to weathered granite ranges from 20 to 40 inches.

Rock outcrop consists of areas of exposed granite.

Of minor extent in this map unit are the Brickel, Mobate, Skanid, and Vassar soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for wildlife habitat, recreation, watersheds, and homesite development. Small areas may be used for nonirrigated cropland.

The main limitations for homesite development are steepness of slope, depth to rock, and Rock outcrop.

2 Huckleberry-Raisio-Hartill

Moderately deep, well drained, nearly level to very steep soils formed in material weathered from shaly rock; on mountains

This map unit is in the south-central and southeastern parts of the county. Huckleberry soils are on north-facing slopes at an elevation of more than 3,000 feet. Raisio soils are mainly on south-facing slopes. Hartill soils are mainly on north-facing slopes at an elevation of 2,000 to 3,000 feet. This unit is characterized by sharp ridgetops and steep, smooth foot slopes and side slopes. Drainageways are deeply dissected. Slope ranges from 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation ranges from 1,800 to 6,000 feet. Average annual precipitation ranges from 20 to 45 inches, average annual air temperature ranges from 43° to 47° F, and the average frost-free season ranges from 70 to 120 days.

This map unit makes up about 13 percent of the survey area. It is about 35 percent Huckleberry soils, 25 percent Raisio soils, 15 percent Hartill soils, and 25 percent soils of minor extent.

The Huckleberry soils are on toe slopes, foot slopes, side slopes, and ridgetops of mountains. These soils formed in residuum weathered from shaly rock and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The surface layer is silt loam after mixing. The subsoil is silt loam. The upper part of the substratum is shaly silt loam, and the lower part of the substratum is very shaly loam over phyllite at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches.

The Raisio soils are on south-facing foot slopes, side slopes, and ridgetops of mountains. These soils formed in residuum weathered from shaly rock that is modified in places by glacial till and volcanic ash. The surface is covered with a mat of partially decomposed organic litter. The surface layer is shaly loam. The subsoil is very flaggy loam. The substratum is extremely flaggy loam over phyllite at a depth of about 30 inches. Depth to bedrock ranges from 20 to 40 inches.

The Hartill soils are on toe slopes, foot slopes, side slopes, and ridgetops of mountains. They formed in colluvium and residuum weathered from shaly rock and are mantled with volcanic ash. The surface is covered with a mat of partially decomposed organic litter. The subsurface layer is very fine sandy loam. The subsoil is silt loam. The upper part of the substratum is shaly loam, and the lower part of the substratum is very shaly loam over phyllite at a depth of about 37 inches. Depth to bedrock ranges from 20 to 40 inches.

Of minor extent in this map unit are the Buhrig and Rufus soils and Rock outcrop.

The soils in this unit are used for grazeable woodland. Some areas are used for recreation, wildlife habitat, watersheds, and homesite development. Small areas may be used for nonirrigated cropland.

The main limitations for homesite development are steepness of slope, depth to rock, and large stones.

soils on foothills

This group consists of five map units. It makes up about 58 percent of the survey area. The soils in this group range from nearly level to very steep. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation ranges from 1,400 to 5,500 feet. Average annual precipitation ranges from 15 to 35 inches, average annual air temperature ranges from 43° to 47° F, and the frost-free season ranges from 80 to 135 days. These soils are very deep and moderately deep, and well drained and moderately well drained. They formed in mixed glacial till, colluvium, and residuum, with a mantle or admixture of volcanic ash and loess.

This group of soils is mainly used for grazeable woodland. Some areas are used for nonirrigated and irrigated cropland, rangeland, watersheds, wildlife habitat, recreation, and homesite development.

3 Aits-Newbell-Donavan

Very deep, well drained, nearly level to very steep soils formed in mixed glacial till, with a mantle or admixture of volcanic ash and loess; on foothills

This map unit is on foothills throughout the county. Slope ranges from 0 to 65 percent. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 2,000 to 5,000 feet. Average annual precipitation ranges from 17 to 35 inches, average annual air temperature ranges from 43° to 46° F, and the frost-free season ranges from 90 to 120 days.

This map unit makes up about 37 percent of the survey area. It is about 35 percent Aits soils, 25 percent Newbell soils, 20 percent Donavan soils, and 20 percent soils of minor extent.

The nearly level to very steep Aits soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are very deep and well drained. They formed in glacial till and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The surface layer and subsoil are stony loam. The upper part of the substratum is gravelly loam, and the lower part of the substratum is very gravelly clay loam to a depth of 60 inches or more.

The nearly level to very steep Newbell soils are on foothills. These soils are very deep and well drained. They formed in glacial till weathered mainly from granite and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The subsurface layer and subsoil are silt loam. The substratum is very gravelly sandy loam to a depth of 60 inches or more.

The nearly level to very steep Donavan soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are very deep and well drained. They formed in mixed glacial till, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The surface layer is loam in the upper part and gravelly loam in the lower part. The underlying material is cobbly sandy loam to a depth of 60 inches or more.

Of minor extent in this map unit are the Dehart, Manley, Merkel, and Waits soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for recreation, wildlife habitat, watersheds, and homesite development. Small areas may be used for nonirrigated cropland.

The main limitation for homesite development is steepness of slope. The main limitations for septic tank absorption fields are permeability and steepness of slope.

4 Belzar-Smackout-Maki

Moderately deep and very deep, well drained, nearly level to very steep soils formed in glacial tiff from shaly rock and residuum and colluvium from limestone, with a mantle or admixture of volcanic ash and loess; on foothills

This map unit is in the northeastern part of the county. Slope ranges from 0 to 65 percent. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 1,400 to 5,500 feet. Average annual precipitation ranges from 15 to 35 inches, average anneal air temperature ranges from 44° to 47° F, and the average frost-free season ranges from 80 to 130 days.

This map unit makes up about 5 percent of the survey area. It is about 20 percent Belzar soils, 15 percent Smackout soils, 10 percent Maki soils, and 55 percent soils of minor extent.

The nearly level to very steep Belzar soils are on foot slopes and ridgetops of foothills. These soils are moderately deep and well drained. They formed in residuum and colluvium weathered from calcareous shaly rock and limestone and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The subsoil is silt loam. The upper part of the substratum is channery loam, and the lower part of the substratum is very channery and extremely channery loam over unweathered, calcareous phyllite at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches.

The nearly level to very steep Smackout soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are very deep and moderately well drained. They formed in glacial till weathered mainly from shale and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The surface layer and upper part of the subsoil are loam. The lower part of the subsoil is gravelly loam, gravelly silty clay loam, and gravelly sandy clay loam. The substratum is gravelly loam to a depth of 60 inches or more.

The steep to very steep Maki soils are on south-facing foot slopes and side slopes of foothills. These soils are moderately deep and well drained. They formed in residuum, colluvium, and glacial till weathered mainly from calcareous rocks, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The surface layer is gravelly loam. The subsoil is very gravelly loam over unweathered, calcareous shale at a depth of about 23 inches. Depth to the shale ranges from 20 to 40 inches.

Of minor extent in this map unit are the Ahren, Aits, Hartill, Koseth, Leadpoint, and Waits soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for recreation, wildlife habitat, watersheds, and homesite development. Small areas are used for nonirrigated cropland.

The main limitations for homesite development are steepness of slope and the shrink-swell potential. The main limitations for septic tank absorption fields are depth to rock, steepness of slope, and permeability.

5 Inkler-Rock outcrop-Thout

Moderately deep and very deep, well drained, nearly level to very steep soils formed in glacial till, colluvium, and residuum, with a mantle or admixture of volcanic ash and loess, and Rock outcrop; on foothills

This map unit is on foot slopes mainly north of the Columbia River. Slope ranges from 0 to 65 percent. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 2,200 to 4,500 feet. Average annual precipitation ranges from 20 to 35 inches, average annual air temperature is about 43° F, and the average frost-free season ranges from 90 to 120 days.

This map unit makes up about 2 percent of the survey area. It is about 40 percent Inkler soils, 35 percent Rock outcrop, 20 percent Thout soils, and 5 percent soils of minor extent.

The nearly level to very steep Inkier soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are very deep and well drained. They formed in colluvium, residuum, and glacial till, with an admixture of volcanic ash. The surface layer and subsoil are gravelly silt loam. The upper part of the substratum is very gravelly loam and very cobbly loam. The lower part of the substratum is very cobbly sandy clay loam to a depth of 60 inches or more.

Rock outcrop consists of areas of exposed andesite, quartzite, or phyllite.

The gently sloping to very steep Thout soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are moderately deep and well drained. They formed in colluvium, residuum, and glacial till, with an admixture of volcanic ash. The surface is covered with a mat of partially decomposed organic material. The surface layer is gravelly loam. The subsoil is very gravelly loam. The substratum is very gravelly loam over andesite at a depth of about 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Of minor extent in this map unit are the Aits soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for recreation, wildlife habitat, watersheds, and homesite development. A few areas are used for nonirrigated cropland.

The main limitations for homesite development and septic tank absorption fields are steepness of slope, depth to rock, and Rock outcrop.

6 Stevens-Rock outcrop-Dragoon

Moderately deep and very deep, well drained, nearly level to very steep soils formed in residuum from granite and glacial till and Rock outcrop; on foothills

This map unit is mainly on foothills along the Columbia, Spokane, and Kettle Rivers and on alpine meadows. Slope ranges from 0 to 65 percent. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 1,700 to 3,000 feet. Average annual precipitation ranges from 17 to 21 inches, average annual air temperature is about 47° F, and the average frost-free season ranges from 110 to 130 days.

This map unit makes up about 7 percent of the survey area. It is about 55 percent Stevens soils, 10 percent Rock outcrop, 10 percent Dragoon soils, and 25 percent soils of minor extent.

The nearly level to very steep Stevens soils are on south-facing toe slopes, foot slopes, side slopes, and ridgetops of foothills. These soils are very deep and well drained. They formed in mixed glacial till, with an admixture of loess and volcanic ash. The surface layer is silt loam. The subsoil and substratum are gravelly loam to a depth of 60 inches or more.

Rock outcrop consists of areas of exposed granite, argillite, quartzite, limestone, and phyllite.

The nearly level to steep Dragoon soils are on toe slopes and foot slopes of foothills. These soils are moderately deep and well drained. They formed in residuum weathered from granite, with an admixture of loess and volcanic ash. The surface layer is sit loam. The subsoil is clay loam over weathered granite at a depth of about 30 inches. Depth to weathered granite ranges from 20 to 40 inches.

Of minor extent in this map unit are the Molcal; Hunters; Republic; Scoap; and Aquolls, sloping, soils.

The soils in this unit are mainly used for grazeable woodland and for nonirrigated and irrigated cropland. Some areas are used for recreation, rangeland, watersheds, wildlife habitat, and homesite development.

The main limitations for homesite development are steepness of slope and Rock outcrop. The main limitations for septic tank absorption fields are steepness of slope, depth to rock, and Rock outcrop.

7 Bernhill-Green Bluff-Dearyton

Very deep, well drained and moderately well drained, nearly level to very steep soils formed in mixed glacial till, with a mantle or admixture of loess and volcanic ash; on basalt plateaus and foothills

This map unit is in the southern part of the county. Slope ranges from 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation ranges from 1,800 to 3,000 feet. Average annual precipitation ranges from 18 to 25 inches, average annual air temperature is about 46° F, and the average frost-free season ranges from 105 to 135 days.

This map unit makes up about 7 percent of the survey area. It is about 55 percent Bernhill soils, 25 percent Green Bluff soils, 10 percent Dearyton soils, and 10 percent soils of minor extent.

The nearly level to very steep Bernhill soils are on toe slopes, foot slopes, and side slopes of foothills. These soils are well drained. They formed in glacial till and are mantled with volcanic ash and loess. The surface layer is silt loam. The subsoil and substratum are gravelly loam to a depth of 60 inches or more.

The nearly level to strongly sloping Green Bluff soils are on basalt plateaus. These soils are well drained. They formed in glacial till, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic litter. The subsurface layer is very fine sandy loam. The subsoil is silt loam, and the substratum is loam to a depth of 60 inches or more.

The nearly level to steep Dearyton soils are on toe slopes of basalt plateaus and foothills. These soils are moderately well drained. They formed in glacial till and are mantled with volcanic ash and loess. The surface is covered with a thin mat of partially decomposed organic litter. The surface layer and upper part of the subsoil are silt loam over a loam subsurface layer. The buried subsoil is silty clay and gravelly silty clay to a depth of 60 inches or more.

Of minor extent in this map unit are the Bestrom and Hesseltine soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for nonirrigated cropland and for recreation, watersheds, wildlife habitat, and homesite development.

The main limitations for homesite development are steepness of slope and the shrink-swell potential. The main limitations for septic tank absorption fields are steepness of slope and permeability.

soils on terraces

This group consists of three map units. It makes up about 16 percent of the survey area. The soils in this group range from nearly level to very steep. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation ranges from 1,400 to 4,500 feet. Average annual precipitation ranges from 15 to 35 inches, average annual air temperature ranges from 43° to 47° F, and the average frost-free season ranges from 90 to 130 days. The soils in this group are very deep and somewhat excessively drained, well drained, and moderately well drained. They formed in glaciofluvial material, mixed glacial outwash, and ablation till and are mantled with volcanic ash and loess.

This group of soils is mainly used for nonirrigated and irrigated cropland. It is also used for grazeable woodland and for recreation, watersheds, wildlife habitat, and homesite development.

8 Clayton-Cedonia-Martella

Very deep, well drained and moderately well drained, nearly level to very steep soils formed in lake sediment and glaciofluvial material; on terraces and Terrace escarpments

This map unit is along the main drainagewaays throughout the county. It is mainly on terraces and terrace escarpments. Slope ranges from 0 to 65 percent. This unit is characterized by nearly level to moderately steep terraces with steep to very steep terrace escarpments. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 1,400 to 3,000 feet. Average annual precipitation ranges from 1 to 30 inches, average annual air temperature ranges from 44° to 47° F, and the average frost-free season ranges from 90 to 130 days.

This map unit makes up about 5 percent of the survey area. It is about 30 percent Clayton soils, 20 percent Cedonia soils, 20 percent Martella soils, and 30 percent soils of minor extent.

The nearly level to strongly sloping Clayton soils are on terraces. These soils are well drained. They formed in mixed glaciofluvial material. The surface is covered with a mat of partially decomposed organic material. The subsurface layer is very fine sandy loam. The subsoil is fine sandy loam. The upper part of the substratum is fine sandy loam, and the lower part of the substratum is loamy fine sand to a depth of 60 inches or more.

The nearly level to moderately steep Cedonia soils are on terraces, and the steep to very steep Cedonia soils are on terrace escarpments. The soils are well drained. They formed in glacial lake sediment and are mantled with volcanic ash and loess. These soils are silt loam throughout to a depth of 60 inches or more. The substratum is calcareous.

The nearly level to steep Martella soils are on terraces and terrace escarpments. These soils are moderately well drained. They formed in glacial lake sediment and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The subsurface layer is very fine sandy loam. The upper part of the subsoil is silt loam, and the lower part of the subsoil is silt loam and silty clay loam. The substratum is laminated silt loam with silty clay loam.

Of minor extent in this map unit are the Hodgson, Koerling, Laketon, and Wolfeson soils.

The soils in this unit are mainly used for grazeable woodland and for nonirrigated and irrigated crop and. Some areas are used for recreation, homesite development, watersheds, and wildlife habitat.

The main limitation for homesite development is steepness of slope. The main limitations for septic tank absorption fields are permeability and steepness of slope.

9 Bonner-Eloika-Scrabblers

Very deep, well drained, nearly level to very steep soils formed in glacial outwash; on terraces and terrace escarpments

This map unit is in the vicinity of Deer, Loon, Waits, Little Pend Oreille, and Pierre Lakes and others. It is also along the Columbia, Colville, and Kettle Rivers and their tributaries, mainly on terraces and terrace escarpments. This unit is characterized by broad, nearly level to strongly sloping terraces and moderately steep to very steep terrace escarpments. Slope ranges from 0 to 65 percent. The vegetation is conifers, shrubs, forbs, and grasses. Elevation ranges from 1,800 to 4,500 feet. Average annual precipitation ranges from 18 to 35 inches, average annual air temperature ranges from 43° to 46° F, and the average frost-free season ranges from 90 to 125 days.

This map unit makes up about 5 percent of the survey area. It is about 65 percent Bonner soils, 15 percent Eloika soils, 10 percent Scrabblers soils, and 10 percent soils of minor extent.

The nearly level to strongly sloping Bonner soils are on terraces, and the moderately steep to very steep Bonner soils are on terrace escarpments. These soils are very deep and well drained. They formed in glacial outwash of mixed mineralogy and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The upper part of the subsoil is silt loam, and the lower part of the subsoil is gravelly loam. The upper part of the substratum is gravelly loamy sand, and the lower part is very gravelly loamy sand to a depth of 60 inches or more.

The nearly level to steep Eloika soils are on terraces and terrace escarpments. These soils are very deep and well drained. They formed in gravelly glacial outwash or ablation till of mixed mineralogy and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The upper part of the subsoil is silt loam, mixed to a depth of 6 inches. The lower part of the subsoil is loam. The upper part of the substratum is gravelly loam, and the lower part is very gravelly sandy loam and extremely gravelly coarse sand to a depth of 60 inches or more.

The nearly level to very steep Scrabblers soils are on terraces and terrace escarpments. These soils are very deep and well drained. They formed in sandy glacial outwash derived mainly from weathered granite and are mantled with volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The upper part of the subsoil is very fine sandy loam, and the lower part of the subsoil is sandy loam. The substratum is gravelly loamy sand to a depth of 60 inches or more.

Of minor extent in this map unit are the Hagen and Kiehl soils.

The soils in this unit are mainly used for grazeable woodland. Some areas are used for cropland and for recreation, home development, and wildlife habitat.

The main limitation for homesite development is steepness of slope. The main limitations for septic tank absorption fields are poor filtering and steepness of slope.

10 Springdale-Spens-Bisbee

Very deep, somewhat excessively drained, nearly level to very steep soils formed in glacial out wash; on terraces and terrace escarpments

This map unit is near the Colville, Columbia, Spokane, and Kettle Rivers, and their tributaries. This unit is characterized by nearly level to moderately steep terraces and steep to very steep terrace escarpments. Slope ranges from 0 to 65 percent. The vegetation on these soils is scattered conifers, shrubs, forbs, and grasses. Elevation ranges from 1,400 to 2,300 feet. Average annual precipitation ranges from 16 to 23 inches, average annual air temperature is about 47° F, and the average frost-free season ranges from 100 to 130 days.

This map unit makes up about 6 percent of the survey area. It is about 25 percent Springdale soils, 20 percent Spens soils, 20 percent Bisbee soils, and 35 percent soils of minor extent.

The nearly level to strongly sloping Springdale soils are on terraces. These soils formed in glacial outwash, with an admixture of volcanic ash and loess. The surface is covered with a mat of partially decomposed organic material. The surface layer is gravelly sandy loam. The upper part of the underlying material is gravelly sandy loam. The lower part of the underlying material is very gravelly loamy coarse sand and extremely cobbly coarse sand to a depth of 60 inches or more.

The moderately steep to very steep Spens soils are on terrace escarpments. These soils formed in mixed glacial outwash and colluvial material. They are extremely gravelly loamy coarse sand throughout to a depth of 60 inches or more.

The nearly level to strongly sloping Bisbee soils are on undulating dunelike terraces, and the steep Bisbee soils are on terrace escarpments. These soils formed in wind worked, mixed sandy outwash material. The surface is covered with a thin mat of partially decomposed organic material. The surface layer is loamy fine sand. The underlying material is loamy fine sand and sand to a depth of 60 inches or more.

Of minor extent in this unit are the Bong, Cheney, Garrison, Phoebe, Marble, and Dart soils.

The soils in this unit are mainly used for grazeable woodland and for nonirrigated and irrigated cropland. Some areas are used for recreation, homesite development, watersheds, and wildlife habitat.

The main limitations for homesite development are steepness of slope and large stones. The main limitations for septic tank absorption fields are poor filtering and steepness of slope.

soils on flood plains

This group consists of one map unit. It makes up about 5 percent of the survey area. The soils in this group are nearly level. The vegetation is mainly deciduous trees, conifers, forbs, shrubs, and water-tolerant grasses. Elevation ranges from 1,400 to 3,000 feet. Average annual precipitation ranges from 13 to 24 inches, average annual air temperature is about 46° F, and the frost-free season ranges from 90 to 125 days.

The soils in this group are very deep and moderately well drained and poorly drained. They formed in mixed alluvium and alluvium from volcanic ash.

This group of soils is mainly used for nonirrigated cropland and rangeland. Some areas are used for wildlife habitat, recreation, homesite development, and woodland.

11 Colville-Peone-Narcisse

Very deep, moderately well drained and poorly drained, nearly level soils; on bottom lands, flood plains, alluvial fans, perimeters of lakes, and in depressional areas

This map unit is scattered throughout the survey area. Slope ranges from 0 to 3 percent.

This map unit makes up about 5 percent of the survey area. It is about 20 percent Colville soils, 10 percent Peone soils, 10 percent Narcisse soils, and 60 percent soils of minor extent.

The nearly level Colville soils are on bottom lands. These soils are poorly drained. They formed in mixed alluvium. The surface layer is silt loam. The subsoil is silty clay loam. The substratum is silty clay loam and silt loam to a depth of 60 inches or more.

The nearly level Narcisse soils are on bottom lands and in depressional areas. These soils are moderately well drained. They formed in mixed alluvium. The surface layer is silt loam. The subsoil is loam. The substratum is sandy loam to a depth of 60 inches or more.

The nearly level Peone soils are on flood plains, in depressional areas, and on alluvial fans. These soils are poorly drained. They formed in mixed alluvium, including volcanic ash and diatomite. The surface layer is silt loam. The upper part of the underlying layer is silt loam. The lower part of the underlying layer is sandy loam to a depth of 60 inches or more.

Of minor extent in this map unit are the Bossburg, Bridgeson, Chamokane, Chewelah, Hardesty, Rathdrum, Histosols, Kegel, Konner, Riverwash, Saltese, and Wethey soils, and water areas.

The soils in this unit are mainly used for nonirrigated and irrigated cropland and rangeland. Some areas are used for grazeable woodland and for watersheds, wildlife habitat, recreation, and homesite development.

The main limitations for homesite development are wetness and the hazard of flooding. The main limitations for septic tank absorption fields are wetness, the hazard of flooding, and permeability.

broad land use considerations

The soils in Stevens County vary widely in their potential for major land uses. Approximately 15 percent of the county is used for cultivated crops. The main crops are wheat, barley, alfalfa, and grass. Although this cropland is scattered throughout the county, it is concentrated largely in general soil map units 3, 6, 7, 8, and 11. These soils have high potential for crops. The soils in map unit 11 are occasionally flooded in some areas, mostly in winter and spring. Flooding causes slight to moderate crop damage, generally in the lowest areas. Wetness is the main limitation for crops. The soils in map unit 8 are on glacial lake terraces. The hazard of erosion is the main limitation. Clayton, Cedonia, and Martella soils are the main soils in map unit 6 that are used for cultivated crops. The main soils in map units 3, 6, and 7 are Stevens, Aits, Newbell, Bernhill, Green Bluff, and Dearyton soils. These soils are on glaciated foothills and basalt plateaus. The hazard of erosion is the main limitation.

Approximately 3 percent of Stevens County is used for pasture. The soils in map unit 11 have high potential for grasses and legumes. The main soils in this unit are Colville, Peone, and Narcisse soils on flood plains. Grazing should be restricted early in spring because the soils are then saturated with water.

About 4 percent of the county is used for range. The soils in map units 6 and 11 have high potential for rangeland productivity. Map unit 6 is on foothills scattered throughout the county near the Columbia and Kettle Rivers. The main soils are Stevens and Dragoon. The hazard of erosion is the main limitation. The major soils in map unit 11 are Colville, Peone, and Narcisse soils. Grazing should be restricted early in spring, because at that time the soils are saturated with water.

About 37,359 acres in Stevens County is being used for urban or built-up lands. In general, the soils in map units 8 and 10, along the Spokane, Colville, Columbia, and Kettle Rivers, are the main built-up areas. The Cedonia, Clayton, and Martella soils make up the major built-up areas in map unit 8. The main limitations for homesite development are frost action, slow permeability, and the shrink-swell potential. The Bisbee, Springdale, and Spens soils are the major built-up areas in map unit 10. The main limitations for homesite development in this unit are seepage and caving of cutbanks.

The potential for recreation use ranges from low to high, depending on the intensity of the expected use and the properties of the soils. Most of the soils in map units 8, 9, and 10 have high potential for intensive recreation development. Many of the lakes and rivers in the county are located in these map units. Map unit 11 has low potential for recreation because the soils are subject to flooding. The nearly level to very steep slopes in map units 1 through 7 limit the use of these soils for intensive recreation development, for example, landscaping for campgrounds and picnic areas. All of these map units, however, are suited to extensive recreation uses, such as skiing, hiking, horseback riding, motorbiking, snowmobiling, camping, hunting, and fishing. Small areas that are suited to intensive development are available in all of the map units.

About 70 percent of Stevens County is woodland. The productivity for conifers ranges from low to high. The soils in map units 3 and 6 have potential to produce the largest amount of wood. The main soils in map units 3 and 8 are Aits, Newbell, Clayton, Cedonia, and Martella soils. Map units 7 and 9 also have potential to produce large amounts of wood. The main soils in these units are Bonner, Eloika, Scrabblers, Bernhill, Green Bluff, and Dearyton soils. Most of the woodland is grazed in spring, summer, or fall by livestock, and it is used year-round by large game animals.

Plant competition is generally the greatest hazard to growing trees. Tree establishment may be set back several years following logging because undesirable plants invade and native plants temporarily compete with trees. All of the soils on the steeper slopes are subject to erosion, and this factor needs to be considered when harvesting operations are planned.

Wildlife habitat

A small percentage of the total area in Stevens County is managed for fish and wildlife use. The well-being of wildlife is largely determined by the quantity and quality of the habitat produced on the soils managed for rangeland, woodland, or cropland.

Wooded soils in general map units 1, 2, 6, 9, and 10 provide habitat for deer, bear, and grouse. Scattered, small and irregularly shaped, logged, open areas among the trees support wildlife by providing grasses, forbs, and shrubs. Timber management that benefits wildlife includes maintaining snags; maintaining uneven-aged stands of trees of mixed species, including deciduous trees; and protecting riparian vegetation and the water quality in streams. Important food resources for many forms of wildlife are promoted if logged and burned areas, roadsides, and critically eroding areas are seeded with herbaceous plants, particularly legumes.

The use of fire and mechanical means can set back forest succession and allow herbaceous-shrubby vegetation to grow. Livestock grazing needs to be managed to protect the riparian zones. The food and cover requirements of wildlife should be considered when grazing management is planned.

Much of the soil in general soil map units 3, 4, and 5 has been developed for irrigated and nonirrigated cropland and grazeable land. Openings that result from land clearing and agricultural development have improved habitat conditions for some woodland wildlife and have created habitat for openland wildlife, such as pheasants, Hungarian partridge, and meadowlark. Woodland management on these soils that benefits wildlife is the same as that cited for general map units 1, 2, 8, 9, and 10.

Soil conservation practices that benefit wildlife are planting cover crops or maintaining abundant crop residue during winter, leaving uncultivated strips of vegetation along shorelines and streambanks, proper grazing of pasturelands, closely regulating livestock use in streams and wetlands, and controlling runoff from animal holding areas. Pesticides should be used carefully.

Habitat for openland wildlife can be improved in many areas by establishing year-round patches or rows of woody cover and by developing additional sources of water, for example, ponds, springs, seeps, and wetlands. Small patches of grain left standing throughout the winter benefit both woodland and openland wildlife.

The soils in map units 7 and 8 are a mixture of woodland; grazeable woodland; and, to a minor extent, nonirrigated cropland. The soil conservation practices for soils on mountains and soils on terraces also apply to the soils on uplands and plateaus.

Soils in map unit 11 are along adjacent streams and in poorly drained depressional and wetland areas. These soils provide habitat for wetland wildlife, provide protective cover for openland wildlife, and provide an integral component of stream habitat for both fish and small mammals. Riparian plant communities provide a diverse habitat used by a large number of fish and wildlife species.

Conservation practices that benefit wildlife include protecting riparian vegetation from cultivation, fire, herbicides, and excessive grazing; and protecting wetlands from filling, draining, and excess sedimentation. Riparian plant communities can be reestablished if they are protected from disturbance and herbaceous and woody species are planted. Grain crops that are planted adjacent to wetlands or that are seasonally inundated by water provide extremely valuable waterfowl habitat. Many wetlands and wet depressional areas can be improved by diking and installing water-control structures. Ponds constructed on these soils can provide recreational fishing as well as habitat for wildlife.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Aits loam, 15 to 25 percent slopes, is one of several phases in the Aits series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Aits-Rock outcrop complex, 0 to 40 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 2 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1-Ahren loam, 2 to 20 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in calcareous glacial till mainly derived from shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with an organic mat about 1 1/2 inches thick. The subsoil is yellowish brown loam about 12 inches thick. The substratum is calcareous, light brownish gray gravelly loam and gravelly silty clay loam to a depth of 60 inches or more. In places is a similar soil that is noncalcareous.

Included with this soil in mapping are small areas of-

- Ahren loam-on steeper slopes
- Belzar silt loam, 5 to 25 percent slopes-on convex slopes
- Aits loam, 15 to 25 percent slopes, Waits loam, 0 to 15 percent slopes, and Waits loam, 15 to 25 percent slopes-on concave toe slopes and foot slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Ahren soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used mainly for grazeable woodland. A few areas are cleared and used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, ponderosa pine western redcedar, grand fir, lodgepole pine, western hemlock, western white pine, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 100 on the Ahren soil. The basal area is about 69 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, common snowberry, dwarf huckleberry; ninebark, and creambush oceanspray.

Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is well suited to the production of nonirrigated wheat, barley, alfalfa, and grass. The main limitation is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation is annual grain for 2 to 3 years followed by alfalfa and grass for 4 to 8 years.

This soil is suited to homesite development. The main limitations are steepness of slope and the shrink-swell potential. Special design of buildings is needed to overcome the limitation imposed by slope. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass IIIe, nonirrigated.

2-Ahren loam, 20 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in calcareous glacial till mainly derived from shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsoil is yellowish brown loam about 12 inches thick. The substratum is calcareous, light brownish gray gravelly loam and gravelly silty clay loam to a depth of 60 inches or more. In places is a similar soil that is noncalcareous.

Included with this soil in mapping are small areas of-

- Ahren loam, 2 to 20 percent slopes-on concave toe slopes
- Ahren loam, 40 to 60 percent slopes, and Waits loam, 25 to 40 percent slopes-on concave foot slopes
- Aits loam, 25 to 40 percent slopes, and Belzar silt loam, 25 to 40 percent slopes-on convex foot slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Ahren soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high.

This soil is used mainly for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, ponderosa pine, western redcedar, grand fir, lodgepole pine, western hemlock, western white pine, and Engelmann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 100 on the Ahren soil. The basal area is about 69 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch and larger is 70 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on these steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also card be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the understory vegetation is mainly pinegrass, common snowberry, dwarf huckleberry, and creambush oceanspray. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and lass desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

3-Ahren loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in calcareous glacial till mainly derived from shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsoil is yellowish brown loam about 12 inches thick. The substratum is calcareous, light brownish gray gravelly loam and gravelly silty clay loam to a depth of 60 inches or more. In places is a similar soil that is noncalcareous.

Included with this soil in mapping are small areas of-

- Ahren loam, 20 to 40 percent slopes, and Aits loam, 40 to 65 percent slopes-on foot slopes
- Belzar silt loam, 40 to 65 percent slopes-on convex slopes
- Waits loam, 40 to 65 percent slopes-on concave upper slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 25 percent of the total acreage.

The permeability of this Ahren soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, western redcedar, grand fir, lodgepole pine, western hemlock, western white pine, and Engelmann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 100 on the Ahren soil. The basal area is about 69 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels and tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, common snowberry, dwarf huckleberry, and creambush oceanspray.

This soil is in capability subclass VIIe, nonirrigated.

4-Ahren-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north kind east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days. This complex is 60 percent Ahren loam, 40 to 65 percent slopes, and 25 percent Rock outcrop.

Included with this complex in mapping are small areas of-

- Ahren loam, 20 to 40 percent slopes, and Aits loam, 25 to 40 percent slopes-on foot slopes
- Belzar silt loam, 40 to 65 percent slopes-on convex slopes
- Waits loam, 40 to 65 percent slopes-on concave upper side slopes
- very shallow, very stony soils near Rock outcrop and on knobs and ridges
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Ahren soil is very deep and well drained. It formed in calcareous glacial till weathered mainly from shaly rock and limestone and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsoil is yellowish brown loam about 12 inches thick. The substratum is calcareous, light brownish gray gravelly loam and gravelly silty clay loam to a depth of 60 inches or more. In places is a similar soil that is noncalcareous.

The permeability of this Ahren soil is moderately slow, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone or calcareous shale. Most areas are steep to very steep.

The soils in this complex are suited to the production of Douglas-fir. They are also suited to ponderosa pine, western larch, western redcedar, grand fir, lodgepole pine, western hemlock, western white pine, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 100 on the Ahren soil. The basal area is about 52 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 46 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 53 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. Puddling can occur when the soils are wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, lodgepole pine, and western white pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

In most areas of these soils, the understory vegetation is mainly pinegrass, common snowberry, dwarf huckleberry, and creambush oceanspray.

The soils in this complex are in capability subclass VIIs, nonirrigated.

5-Aits loam, 0 to 15 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown loam about 2 inches thick. The subsoil is brown loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Aits loam, 15 to 25 percent slopes, Inkier silt loam, 0 to 20 percent slopes, Smackout loam, 0 to 5 percent slopes, Smackout loam, 5 to 20 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on similar landscape positions
- Hartill silt loam, 0 to 15 percent slope ;-on convex slopes
- soils on outwash and lakebed terrace remnants on the lower parts of foot slopes
- poorly drained soils in drainageways aid soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight

This soil is used for grazeable woodland. A few areas have been cleared and are used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean sure index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas of Douglas-fir, western larch, and Iodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing or browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, ninebark, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass are slope and the hazard of erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 to 3 years followed by alfalfa and grass for 4 to 8 years.

This soil is suited to homesite development. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass Ille, nonirrigated.

6-Aits loam, 15 to 25 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown loam about 2 inches thick. The subsoil is brown loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Inkler silt loam, 0 to 20 percent slopes, Smackout loam, 5 to 20 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on similar landscape positions
- Aits loam, 0 to 15 percent slopes, Aits loam, 25 to 40 percent slopes, and Hartill silt loam, 15 to 25 percent slopes-on convex slopes
- soils on outwash and lakebed terrace remnants on the lower parts of toe slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this soil are used for grazeable woodland. A few areas have been cleared and are used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage system; and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are nod, controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses acid legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass are slope and the hazard of erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IVe, nonirrigated.

7-Aits loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown loam about 2 inches thick. The subsoil is brown loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Inkler gravelly silt loam, 20 to 40 percent slopes, Smackout loam, 20 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on similar landscape positions
- Aits loam, 15 to 25 percent slopes, Aits loam, 40 to 65 percent slopes, and Hartill silt loam, 25 to 40 percent slopes-on convex slopes
- soils on outwash and lakebed terrace remnants on the lower parts of side slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this soil are used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and Saskatoon serviceberry. Thinning, logging, or fire reduces the density of the canopy and allows for increased growth of the understory vegetation. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

8-Aits loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown loam about 2 inches thick. The subsoil is brown loam about 10 inches thick. The upper part of substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Inkler gravelly silt loam, 40 to 65 percent slopes, Smackout loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on similar landscape positions
- Aits loam, 25 to 40 percent slopes, and Hartill silt loam, 40 to 65 percent slopes-on convex slopes
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Most areas of this soil are used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch (fig. 1), and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and Saskatoon serviceberry. Thinning, logging, or fire reduces the density of the canopy cover and allows for increased growth of the understory vegetation. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. The

Figure 1.-Aits loam, 40 to 65 percent slopes, on the timbered slopes supports stands of western larch that followed fire. Eloika silt loam, 0 to 15 percent slopes, is in the foreground.

location of salt licks, stockwatering facilities, and roads or trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

9-Aits stony loam, 0 to 40 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown stony loam about 2 inches thick. The subsoil is brown stony loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam to a depth of about 33 inches. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Inkler gravelly silt loam, 20 to 40 percent slopes, Smackout loam, 30 to 40 percent slopes, and Newbell stony silt loam, 0 to 40 percent slopes on similar landscape positions
- Aits loam, 25 to 40 percent slopes, Hartill silt loam, 15 to 25 percent slopes, and Hartill silt loam, 25 to 40 percent slopes-on convex slopes
- Bonner silt loam and Martella silt loam on outwash and lakebed terrace remnants-on the lower parts of side slopes and foot slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this soil are used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of about 25 to 40 percent.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Thinning, logging, or fire reduces the density of the canopy and allows for increased growth of the understory vegetation. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

10-Aits stony loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown stony loam about 2 inches thick. The subsoil is brown stony loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more. In places is a similar soil that has a dark surface layer.

Included with this soil in mapping are small areas of-

- Inkler gravelly silt loam, 40 to 65 percent slopes, Smackout loam, 40 to 65 percent slopes, and Newbell stony silt loam, 40 to 65 percent slopes-on similar landscape positions
- Aits loam, 40 to 65 percent slopes, and Hartill silt loam, 40 to 65 percent slopes-on convex slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Most areas of this soil are used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling arid gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on steep slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark.

Overgrazing causes the desirable plants, such as pinegrass and ninebark, to decrease and the less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

11-Aits-Rock outcrop complex, 0 to 40 percent slopes. The soils in this complex are on toe slopes and foot slopes of foothills. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days. This complex is about 70 percent Aits stony loam, 0 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are small areas of-

- Newbell silt loam, 25 to 40 percent slopes, Hartill silt loam, 25 to 40 percent slopes, Inkler gravelly silt loam, 20 to 40 percent slopes, arid Smackout loam, 20 to 40 percent slopes-on similar landscape positions
- Bonner silt loam and Martella silt loam on outwash and lakebed terrace remnants-on the lower parts of side slopes and foot slopes
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 10 percent of the total acreage.

The Aits soil is deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown stony loam about 2 inches thick. The subsoil is brown stony loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed granite or quartzite. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 57 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 62 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on these soils and limits access. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the soils that have slopes of about 25 to 40 percent. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

The soils in this complex are in capability subclass VIs, nonirrigated.

12-Aits-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days. This unit is about 70 percent Aits stony loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are small areas of-

- Newbell silt loam, 40 to 65 percent slopes, Aits loam, 40 to 65 percent slopes, Inkler gravelly silt loam, 40 to 65 percent slopes, and Smackout loam, 40 to 65 percent slopes-on similar landscape positions
- Hartill silt loam, 40 to 65 percent slopes-on convex slopes
- very shallow and very stony soils on ridges and knobs
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 10 percent of the total acreage.

The Aits soil is deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown stony loam about 2 inches thick. The subsoil is brown stony loam about 10 inches thick. The upper part of the substratum is light gray and grayish brown gravelly loam about 33 inches thick. The lower part is pale olive very gravelly clay loam to a depth of 60 inches or more.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite and quartzite. Most slopes are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 57 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 62 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop and stones on the surface cause the breakage of timber and hinder yarding operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock. Large cut and fill slopes remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

13-Aquolls, sloping. This very deep, poorly drained soil is on foothills, in concave areas, and in drainageways. This soil formed in alluvium. Slope is 5 to 40 percent. Elevation is 2,000 to 3,500 feet. The native vegetation is hardwoods, conifers, shrubs, grasses, and forbs. The average annual precipitation is about 22 inches, and the average annual air temperature is about 45° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin organic mat. The surface layer is grayish brown silt loam about 19 inches thick. The upper part of the substratum is light gray silt loam about 10 inches thick. The lower part is mottled, light brownish gray gravelly sandy loam to a depth of 60 inches or more. The texture, color, and thickness of the layers vary widely from one area to another and within short distances.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, Newbell silt loam, 40 to 65 percent slopes, Scoap gravelly loam, 40 to 65 percent slopes, and Waits loam, 40 to 65 percent slopes-on all aspects
- Donavan loam, 40 to 65 percent slopes, Molcal gravelly silt loam, 40 to 65 percent slopes, and Stevens silt loam, 8 to 15 percent slopes-on concave, south- and west-facing slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Aquolls soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 4 feet from February through May. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of aspen. It is also suited to birch, Douglas maple, and hawthorn.

Based on an 80-year site curve, the mean site index for aspen is 50 on Aquolls soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6 inches in diameter at breast height (dbh) and larger is 12 cubic feet per acre per year. The CMAI at 110 years of trees 4 inches dbh and larger is 15 cubic feet per acre per year.

This soil is not generally used for the production of wood crops. In spring, the high water table limas the growth of conifers, although seed sources are generally available.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, forbs, and shrubs. Overgrazing causes desirable plants such as pinegrass to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for homesites and septic tank absorption fields are steepness of slope and wetness.

This soil is in capability subclass VIw, nonirrigated.

14-Belzar silt loam, 5 to 25 percent slopes. This moderately deep, well drained soil is on foot slopes and ridgetops of foothills. It formed in residuum and colluvium derived from calcareous, shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The subsoil is brown and light brown silt loam about 13 inches thick. The upper part of the substratum is brown channery loam about 10 inches thick, and the lower part is pale brown very channery loam and extremely channery loam about 15 inches thick. Fractured, calcareous shale is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are small areas of-

- Belzar silt loam, 25 to 40 percent slopes, and Huckleberry silt loam, 15 to 25 percent slopes on north- and east-facing slopes at higher elevations
- Leadpoint silt loam, 0 to 25 percent slopes-in places of contact with dark shaly rock
- Waits loam, 15 to 25 percent slopes-on concave slopes
- Bonner silt loam and Martella silt loam on outwash and lakebed terrace remnants-on the lower parts of foot slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Belzar soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. A few areas, however, are cleared and used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, grand fir, western white pine and lodgepole pine, western hemlock, western redcedar, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Belzar soil. The basal area is about 68 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 46 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 56 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and lodge-pole pine takes place naturally where seed trees are present. The moderate available water capacity influences seedling survival. If openings are made in the canopy, invading brush species that are not controlled will de ay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes car be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. Leading sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth and control erosion. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and the moderate depth to bedrock. Absorption lines should be installed on the contour. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass IVe, nonirrigated.

15-Belzar silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of foothills. It formed in residuum and colluvium derived from calcareous, shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The subsoil is brown and light brown silt loam about 13 inches thick. The upper part of the substratum is brown channery loam about 10 inches thick, and the lower part is pale brown very channery loam and extremely channery loam about 15 inches thick. Fractured, calcareous shale is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are small areas of-

- Belzar silt loam, 5 to 20 percent slopes, and Huckleberry silt loam, 25 to 40 percent slopes on north- and east-facing slopes at higher elevations
- Leadpoint silt loam, 25 to 40 percent slopes-in places of contact with dark shaly rock
- Waits loam, 25 to 40 percent slopes-on concave slopes
- Bonner silt loam and Martella silt loam-on outwash and lakebed terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Belzar soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, grand fir, western white pine and lodgepole pine, western hemlock, western redcedar, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Belzar soil. The basal area is about 68 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 46 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 56 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage system: and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and lodgepole pine takes place naturally where seed trees are present. The moderate available water capacity influences seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas can also be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The limitations for septic tank absorption fields are steepness of slope and the moderate depth to bedrock. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass Vle, nonirrigated.

16-Belzar silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of foothills. It formed in residuum and colluvium derived from calcareous, shaly rock and limestone and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free reason is 80 to 100 days.

Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The subsoil is brown and light brown silt loam about 13 inches thick. The upper part of the substratum is brown channery loam about 10 inches thick, and the lower part is pale brown very channery loam and extremely channery loam about 15 inches thick. Fractured, calcareous shale is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are small areas of-

- Belzar silt loam, 25 to 40 percent slopes, and Huckleberry silt loam, 40 to 65 percent slopes-on north- and east-facing slopes at higher elevations
- Leadpoint silt loam, 40 to 65 percent slopes-in places of contact with dark shaly rock
- Waits loam, 40 to 65 percent slopes-on concave slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Belzar soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, grand fir, western white pine and lodgepole pine, western hemlock, western redcedar, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Belzar soil. The basal area is about 68 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 46 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 56 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and lodgepole pine takes place naturally where seed trees are present. The moderate available water capacity influences seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is in capability subclass VIIe, nonirrigated.

17-Belzar-Rock outcrop complex, 5 to 40 percent slopes. The soils in this complex are on foot slopes and ridgetops of foothills. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days. This unit is about 65 percent Belzar silt loam, 5 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Huckleberry silt loam, 25 to 40 percent slopes on north- and east-facing slopes at higher elevations
- Leadpoint silt loam, 25 to 40 percent slopes-in places of contact with dark shaly rock
- Waits loam, 25 to 40 percent slopes-on concave slopes
- Bonner silt loam and Martella silt loam-on outwash and lakebed terrace remnants
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Belzar soil is moderately deep and well drained. It formed in residuum and colluvium derived from calcareous, shaly rock and limestone and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The subsoil is brown and light brown silt loam about 13 inches thick. The lower part of the profile is pale brown very channery loam and extremely channery loam about 15 inches thick. Fractured, calcareous shale is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Belzar soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed limestone or calcareous shale. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Western larch, grand fir, western white pine, and lodgepole pine also grow on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Belzar soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 37 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 44 cubic feet per acre per year.

Using standard equipment with wheels or tracks on these soils causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access. Outcrops of rock can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock. Roads are more costly to construct and maintain on soils that have slopes of 25 to 40 percent.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and lodgepole pine takes place naturally where seed trees are present. The moderate available water capacity influences seedling survival. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas can also be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are steepness of slope and the moderate depth to bedrock. Special design is needed because of the limited depth of soil over the bedrock.

The soils in this complex are in capability subclass VIs, nonirrigated.

18-Belzar-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days. This unit is about 65 percent Belzar silt loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Huckleberry silt loam, 40 to 65 percent slopes on north- and east-facing slopes at higher elevations

- Leadpoint silt loam, 40 to 65 percent slopes-in places of contact with dark shaly rock
- Waits loam, 40 to 65 percent slopes--on concave slopes
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Belzar soil is moderately deep and well drained. It formed in residuum and colluvium derived from calcareous, shaly rock and limestone and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The subsoil is brown and light brown silt loam about 13 inches thick. The upper part of the substratum is brown channery loam about 10 inches thick, and the lower part is pale brown very channery loam and extremely channery loam about 15 inches thick. Fractured, calcareous shale is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Belzar soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone or calcareous shale. Most areas are steep or very steep.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. Western larch, grand fir, western white pine and lodgepole pine, western hemlock, western redcedar, and Englemann spruce also grow on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Belzar soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 37 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 44 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Outcrops of rock can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and lodgepole pine takes place naturally where seed trees are present. The moderate available water capacity influences seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

In most areas of these soils, the understory vegetation is mainly pinegrass, ninebark, spirea, creambush oceanspray, Saskatoon serviceberry, thimbleberry, rose, common snowberry, pachystima, Oregon-grape, and kinnikinnick.

The soils in this complex are in capability subclass VIIs, nonirrigated.

19-Bernhill very stony loam, 0 to 40 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown very stony loam about 5 inches thick, and the lower part is light brownish gray very stony loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly heavy loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes-on similar landscape positions
- Donavan stony loam, 0 to 30 percent slopes-on south- and west-facing slopes
- Spokane stony loam, 0 to 40 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used mainly for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-acted, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

Unsurfaced roads and skid trails become sticky, slick, and almost impassable when this soil is wets. Stones on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of 25 to 40 percent.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas can also be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. A planned grazing system in which two or more grazing units are alternately rested from grazing over a period of years helps to improve and maintain the understory vegetation. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIs, nonirrigated.

20-Bernhill very stony loam, 40 to 65, percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown very stony loam about 5 inches thick, and the lower part is light brownish gray very stony loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 40 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes on south- and west-facing slopes
- Spokane stony loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. Stones on the surface can cause breakage of timber and hinder yardage operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pine grass, bluebunch wheatgrass, ceanothus, and snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass Vlls, nonirrigated.

21-Bernhill silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown silt loam about 5 inches thick, and the lower part is light brownish gray loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 15 to 25 percent slopes-on similar landscape positions
- Donavan loam, 8 to 25 percent slopes-on southand west-facing slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- Spokane loam, 0 to 25 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland. However, small areas are cleared and used for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is slope. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating maximum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation is annual grain for 2 or 3 years followed by alfalfa and grass for 4 to 8 years.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope. Absorption lines should be installed on the contour.

This soil is in capability subclass Ille, nonirrigated.

22-Bernhill silt loam, 15 to 25 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown silt loam about 5 inches thick, and the lower part is light brownish gray loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 0 to 15 percent slopes, and Bernhill silt loam, 25 to 40 percent slopes-on similar landscape positions
- Donavan loam, 8 to 25 percent slopes--on south and west-facing slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- Spokane loam, 0 to 25 percent slopes--on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. However, small areas are cleared and used for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species will delay the establishment of regeneration if they are not controlled. Areas can also be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are slope and the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. In addition, practices such as divided slope farming and stripcropping, and the use of diversions or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass IVe, nonirrigated.

23-Bernhill silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown silt loam 5 inches thick, and the lower part is light brownish gray loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 15 to 25 percent slopes-on similar landscape positions

- Donavan loam, 25 to 40 percent slopes-on south and west-facing slopes
- Spokane loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush specifies that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. The native vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIe, nonirrigated.

24-Bernhill silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days.

Typically, the upper part of the surface layer is grayish brown silt loam about 5 inches thick, and the lower part is light brownish gray loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes-on similar landscape positions
- Donavan loam, 40 to 65 percent slopes-on south- and west-facing slopes
- Spokane loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Bernhill soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 54 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. The proper location for salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope can limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

25-Bernhill-Rock outcrop complex, 0 to 25 percent slopes. The soils in this complex are on toe slopes of foothills. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 days. This unit is about 70 percent Bernhill very stony loam, 0 to 25 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Bernhill silt loam, 15 to 25 percent slopes-in similar landscape positions
- Donavan loam, 8 to 25 percent slopes-on southand west-facing slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- Spokane loam, 0 to 25 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- very shallow and very stony soils

The included areas make up about 10 percent of the total acreage.

The Bernhill soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the upper part of the surface layer is grayish brown very stony loam about 5 inches thick, and the lower part is light brownish gray very stony loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is pale brown gravelly loam to a depth of 60 inches or more.

The permeability of this Bernhill soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed basalt or granite. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. They are also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 43 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 41 cubic feet per acre per year.

Unsurfaced roads and skid trails become sticky, slick, and almost impassable when these soils are wet. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails converge to avoid large outcrops of rocks.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope.

Excavations for building sites are limited by Rock outcrop. The main limitations for septic tank absorption fields are steepness of slope and Rock outcrop. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, irrigated.

26-Bernhill-Rock outcrop complex, 25 to 65 percent slopes. The soils in this complex are on foot slopes and side slopes of foothills. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season is 105 to 125 clays. This complex is about 70 percent Bernhill very stony loam, 25 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Bernhill silt loam, 40 to 65 percent slopes-on similar landscape positions
- Donavan loam, 40 to 65 percent slopes-on south- and west-facing slopes
- Spokane loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes in places of granite contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- very shallow and very stony soils

The included areas make up about 10 percent of the total acreage.

The Bernhill soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the upper part of the surface layer is grayish brown very stony loam about 5 inches thick, and the lower part is brownish gray very stony loam about 7 inches thick. The upper part of the subsoil is pale brown gravelly loam about 6 inches thick, and the lower part is yellowish brown gravelly loam about 20 inches thick. The substratum is gravelly loam to a depth of 60 inches or more.

The permeability of this Bernhill soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed basalt or granite. Most areas are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. Douglas-fir, western larch, and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 96 on the Bernhill soil. The basal area is about 43 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 41 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, lodgepole pine, western larch, and Douglas-fir takes place naturally if seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas can also be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, ceanothus, and common snowberry. Thinning, logging, or fire reduces the density of the canopy and allows for increased growth of the understory vegetation. Overgrazing causes desirable plants to decrease and less desirable plants to increase. A planned grazing system in which two or more grazing units are alternately rested from grazing over a period of years helps to improve and maintain the understory vegetation. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

27-Bestrom silt loam, 0 to 15 percent slopes. This moderately deep, well drained soil is on toe slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 105 to 125 days.

Typically, the surface of this soil is covered with a thin mat of needles, leaves, and twigs. The surface layer is grayish brown silt loam about 6 inches thick. The subsoil is brown gravelly loam about 10 inches thick. The substratum is light yellowish brown and pale brown gravelly loam about 21 inches thick. It is underlain by basalt at a depth of about 37 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 Inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 0 to 15 percent slopes, and Bestrom silt loam, 15 to 25 percent slopes-on similar landscape positions
- Donavan loam, 8 to 25 percent slopes-on south and west-facing slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Bestrom soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland. However, small areas are cleared and used for nonirrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir is also suited to this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bestrom soil. The basal area is about 46 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 39 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, spirea, common snowberry, and lupine. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is steepness of slope. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. In addition, the use of terraces, diversions, and stripcropping, either singly or in combination, is advisable on long slopes. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 or 3 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitation is the moderate depth to bedrock. Excavations for building sites are limited by bedrock. Because of the limited depth of soil over the bedrock, special design of septic tank absorption fields is needed.

This soil is in capability subclass IIIe, nonirrigated.

28-Bestrom silt loam, 15 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. The elevation is 1,800 to 2,800 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 105 to 125 days.

Typically, the surface of this soil is covered with a thin mat of needles, leaves, and twigs. The surface layer is grayish brown silt loam about 6 inches thick. The subsoil is brown gravelly loam about 10 inches thick. The substratum is light yellowish brown and pale brown gravelly loam about 21 inches thick. It is underlain by basalt at a depth of about 37 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 0 to 15 percent slopes, and Bestrom silt loam, 25 to 40 percent slopes-on similar landscape positions
- Donavan loam, 8 to 25 percent slopes-on south and west-facing slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- poorly drained soils in drainageways and soils adjacent to seeps and springs

- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Bestrom soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. However, small areas are cleared and used for nonirrigated crops.

This soil is suited to the production of ponderosa pine and Douglas-fir.

Based on a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bestrom soil. The basal area is about 46 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 39 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and-Douglas-fir takes places naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, spirea, common snowberry, and lupine. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early seeding, and cross slops, chiseling help to control sheet and rill erosion. Leaving sufficient crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, control erosion, and conserve moisture. In addition, the use of divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are steepness of slope and the moderate depth to bedrock. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass IVe, nonirrigated.

29-Bestrom silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 105 to 125 days.

Typically, the surface of this soil is covered with a thin mat of needles, leaves, and twigs. The surface layer is grayish brown silt loam about 6 inches thick. The subsoil is brown gravelly loam about 10 inches thick. The substratum is light yellowish brown and pale brown gravelly loam about 21 inches thick. It is underlain by basalt at a depth of about 37 inches. The depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes, and Bestrom silt loam, 15 to 25 percent slopes-on similar landscape positions
- Donavan loam, 25 to 40 percent slopes-on south- and west-facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Bestrom soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir is also suited to this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bestrom soil. The basal area is about 46 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 39 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts helps to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, spirea, common snowberry, and lupine. Overgrazing causes desirable plants, such as pinegrass and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are steepness of slope and the depth to rock. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass Vle, nonirrigated.

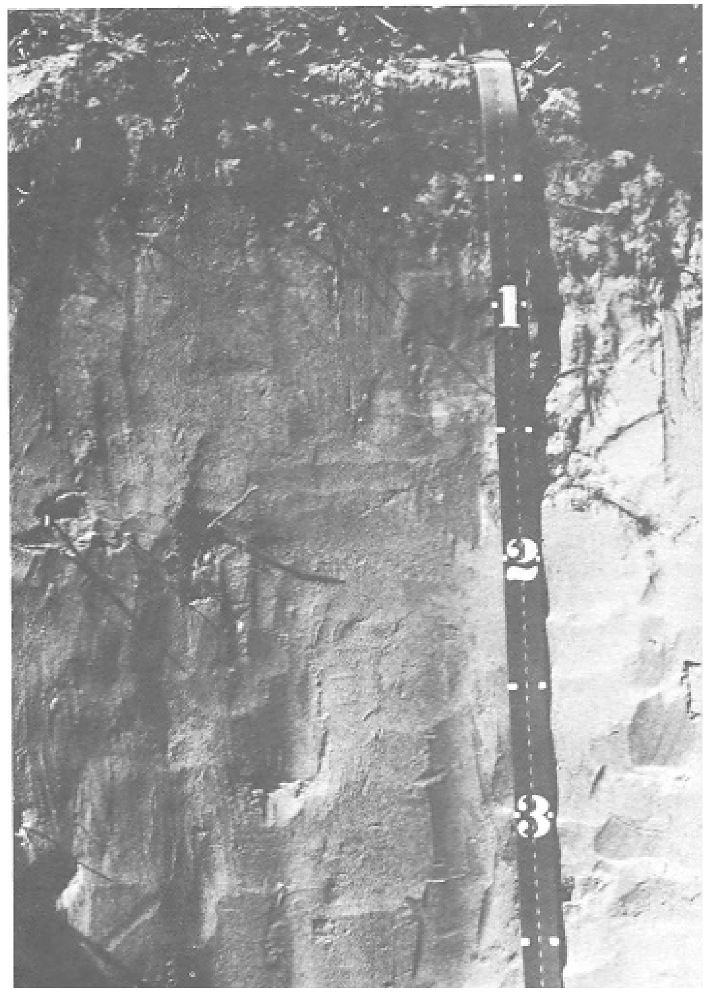

Figure 2.-A profile of Bisbee loamy fine sand. This soil formed in windworked sandy outwash. It is somewhat excessively drained.

30-Bisbee loamy fine sand, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on undulating, dunelike terraces. It formed in windworked, sandy outwash material (fig. 2). The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 /2 inch thick. The surface layer is grayish brown loamy fine sand about 5 inches thick. The underlying material is light brownish gray loamy fine sand about 14 inches thick. Below that is light yellowish brown sand to a depth of 60 inches or more. Iron stains occur in the underlying material. In places is a similar soil that has fine textured lakebed sediment in the underlying material, and a similar soil that has fine textured lakebed sediment in the lower part of the profile.

Included with this soil in mapping are small areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, Marble loamy sand, 5 to 25 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes on similar landscape positions
- Bisbee loamy fine sand, 25 to 45 percent slopes on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Bisbee soil is rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is high.

Most areas of this soil are used for grazeable woodland. However, some areas are used for irrigated and nonirrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil, but it is limited in extent.

Based on a 100-year site curve, the mean site index for ponderosa pine is 104 on the Bisbee soil The basal area is about 46 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is the loose, sandy surface layer. Using standard equipment with wheels or tracks causes rutting and surface displacement when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperature in summer and moderate available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, common snowberry, and balsamroot. Overgrazing causes desirable plants, such as Idaho fescue and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated alfalfa, grass, hay, and wheat is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds help to control wind erosion on nonirrigated cropland. The use of surface residue helps to conserve moisture and also to control wind erosion. Grass, legumes, or grass and legumes planted in rotation are additional ways to provide excellent erosion control. Grassed waterways help to control the water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass-legume hay crops. The main limitations are available water capacity and slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is suited to homesite development. Cutbanks are not stable, however, and are subject to caving. In addition, special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IVe, nonirrigated and irrigated.

31-Bisbee loamy fine sand, 25 to 45 percent slopes. This very deep, somewhat excessively drained soil is on terrace breaks. It formed in windworked, sandy outwash material. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown loamy fine sand about 4 inches thick. The underlying material is light brownish gray loamy fine sand about 14 inches thick. Below that is light yellowish brown sand to a depth of 60 inches or more. Some iron stains occur in the underlying material.

Included with this soil in mapping are small areas of-

- Spens extremely gravelly loamy sand, 25 to 65 percent slopes-on similar landscape positions
- Bisbee loamy fine sand, 0 to 15 percent slopes, Hagen sandy loam, 15 to 40 percent slopes, and Marble loamy sand, 5 to 25 percent slopes

The included areas make up about 20 percent of the total acreage.

The permeability of this Bisbee soil is rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid. The hazards of water erosion and wind erosion are high.

Most areas of this soil are used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil, but it is limited in extent.

Based on a 100-year site curve, the mean site index for ponderosa pine is 104 on the Bisbee soil. The basal area is about 46 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

The main limitations of this soil for the harvesting of timber are the loose, sandy surface layer and steepness of slope. Using standard equipment with wheels or tracks causes rutting and surface displacement when the soil is dry. The use of low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperature in summer and moderate available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, common snowberry, and balsamroot. Overgrazing causes desirable plants, such as Idaho fescue and bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are very rapid permeability in the substratum and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass Vle, nonirrigated.

32-Bong sandy loam, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in mixed, sandy glacial outwash material, with an admixture of volcanic ash and loess. Slopes are complex. The native vegetation is shrubs, grasses, and forbs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 47° F. The frost-free season is 130 to 150 days.

Typically, the surface layer is dark grayish brown sandy loam about 16 inches thick. The subsoil is yellowish brown coarse sandy loam about 8 inches thick. The upper part of the substratum is brown loamy coarse sand about 9 inches thick. The lower part is pale brown coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bong sandy loam, 15 to 25 percent slopes; Cheney stony silt loam, 5 to 25 percent slopes; and Phoebe sandy loam, 5 to 15 percent slopes. These soils are on concave slopes. The included areas make up about 15 percent of the total acreage.

The permeability of this Bong soil is moderately rapid to the substratum and very rapid through it. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight, but the hazard of wind erosion is high.

This soil is used for irrigated and nonirrigated crops and for rangeland.

The main limitations of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass are slope and the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds help to control wind erosion on nonirrigated cropland. The use of surface residue helps to conserve moisture and to control wind erosion. Planting grass, legumes, or grass and legumes in rotation are additional ways to provide excellent wind erosion control. Grassed waterways help to control the water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 or 3 years followed by alfalfa and grass for 4 to 8 years.

This soil is suited to grazing. The native vegetation is mainly bluebunch wheatgrass, needleandthread, Sandberg bluegrass, and Thurber needlegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Thurber needlegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. Cutbanks are not stable, however, and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass Ille, nonirrigated and irrigated.

33-Bong sandy loam, 15 to 25 percent slopes. This very deep, somewhat excessively drained soil is on rolling terraces. It formed in mixed, sandy glacial outwash material, with an admixture of volcanic ash and loess. Slopes are convex. The native vegetation is shrubs, grasses, and forbs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 47° F. The frost-free season is 130 to 150 days.

Typically, the surface layer is dark grayish brown sandy loam about 16 inches thick. The subsoil is yellowish brown coarse sandy loam about 8 inches thick. The upper part of the substratum is brown loamy coarse sand about 9 inches thick. The lower part of the substratum is pale brown coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bong sandy loam, 0 to 15 percent slopes; Cheney stony silt loam, 5 to 25 percent slopes; and Phoebe sandy loam, 5 to 15 percent slopes. These soils are on concave slopes. The included areas make up about 15 percent of the total acreage.

The permeability of this Bong soil is moderately rapid to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is high.

This soil is used for nonirrigated crops and for rangeland.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are slope and the hazards of wind and water erosion. Minimum tillage and early seeding at right angles to the erosive winds help to control wind erosion on nonirrigated cropland. The use of surface residue conserves moisture and also helps to control wind erosion. Planting grass, legumes, or grass and legumes in rotation are additional ways to provide excellent wind erosion control. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass, needleandthread, Sandberg bluegrass, and Thurber needlegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Thurber needlegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or disturbed areas to reduce erosion and provide desirable forage

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility

This soil is in capability subclass IVe, nonirrigated.

34-Bonner gravelly sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in glacial outwash material and is mantled with volcanic ash and loess. Slopes are convex. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 44° F. The frost-free season is 100 to 125 days.

Typically, the surface is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown and light yellowish brown gravelly sandy loam about 17 inches thick, and the lower part is light yellowish brown gravelly loam about 8 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand about 10 inches thick. The lower part of the substratum is pale brown very gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Hagen sandy loam, 15 to 40 percent slopes, and Martella silt loam, 25 to 40 percent slopes, on terrace escarpments. The included areas make up about 20 percent of the total acreage.

The permeability of this Bonner soil is moderately rapid through the subsoil and very rapid through the substratum. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Bonner soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 56 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 65 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, and lodgepole pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and moderate available water capacity reduce the chances of seedling survival. The survival of natural Douglas-fir seedlings may be poor in areas where the surface layer has been displaced by logging operations. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and sedge, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

35-Bonner silt loam, 0 to 10 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash material and is mantled with volcanic ash and loess. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 44° F. The frost-free season is 100 to 125 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown and light yellowish brown silt loam about 17 inches thick, and the lower part is light yellowish brown gravelly loam about 8 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand about 10 inches thick, and the lower part is pale brown very gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner cobbly silt loam, 0 to 10 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Martella silt loam, 5 to 15 percent slopes-on similar landscape positions
- Rathdrum silt loam-on terraces, along intermittent drainageways, and in slight depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Bonner soil is moderately rapid through the subsoil and very rapid through the substratum. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of Douglas-fir. Ponderosa pine and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Bonner soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 56 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch and larger is 65 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil its wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, and lodgepole pine takes place naturally where seed trees are present. However, the high soil surface temperature in summer and moderate available water capacity reduce the chances of seedling survival. The survival of natural Douglas-fir seedlings may be poor in areas where the surface layer has been displaced by logging operations. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and sedges, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is available water capacity. Minimum tillage, early seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. In addition, the use of divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, barley, grain, and legume hay crops. The main limitations are slope and available water capacity. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. Cutbanks are not stable, however, and are subject to caving. In addition, special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IVe, nonirrigated, and IIIe, irrigated.

36-Bonner cobbly silt loam, 0 to 10 percent slopes. This very deep, well drained soil is on terraces.

It formed in glacial outwash material and is mantled with volcanic ash and loess. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 44° F. The frost-free season is 100 to 125 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown and light yellowish brown cobbly silt loam about 17 inches thick, and the lower part is light yellowish brown gravelly loam about 8 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand about 10 inches thick, and the lower part is pale brown very gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Martella silt loam, 5 to 15 percent slopes-on similar landscape positions
- Rathdrum silt loam-on terraces, along intermittent drainageways, and in slight depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Bonner soil is moderately rapid through the subsoil and rapid through the substratum. The available water capacity is moderate. The effective rooting depth is 60 inches or mere. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Bonner soil. The nasal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 56 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 65 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, and lodgepole pine takes place naturally where seed trees are present. However, the high soil surface temperature in summer and moderate available water capacity reduce the chances of seedling survival. The survival of natural Douglas-fir seedlings may be poor in areas where the surface ash layer has beer displaced by logging operations. Areas can also be reforested by the planting of ponderosa pine, Douglas-fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Columbia needlegrass, kinnikinnick, common yarrow, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and Columbia needlegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitation is large stones. Cobbles on the surface may hinder excavations. Cutbanks are not stable and are subject to caving. In addition, special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass Vls, nonirrigated.

37-Bossburg muck. This very deep, very poorly drained soil is on bottom lands adjacent to lakes and ponds. It formed in mixed, alluvial volcanic ash (fig. 3). Slopes are 0 to 3 percent. The native vegetation is water-tolerant grasses, shrubs, and forbs. Elevation is 2,000 to 2,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 125 days.

Typically, the upper part of the surface layer is dark gray muck about 8 inches thick, and the lower part is mottled, very dark gray silt loam about 10 inches thick. The underlying material is mottled, gray and white silt loam about 36 inches thick. It is underlain by a light brownish gray organic layer to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Chamokane loam and Colville silt loam-on bottom lands adjacent to stream channels
- Histosols, ponded, Peone silt loam, and Saltese muck-on bottom lands and along perimeters of lakes

The included areas make up about 15 percent of the total acreage.

The permeability of this Bossburg soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by a seasonal water table that is at or near the surface to a depth of 1 foot from February to May. Runoff is very slow. There is no hazard of water erosion. This soil is subject to frequent flooding for long periods from February to May.

This soil is used mainly for rangeland and for nonirrigated crops.

The main limitation of this soil for the production of wheat, barley, oats, and clover and grass hay is wetness. Drainage will permit earlier spring seeding and provide increased yields. Tile drainage and control structures can be used to control the water table if a suitable outlet is available. Subsidence can be reduced

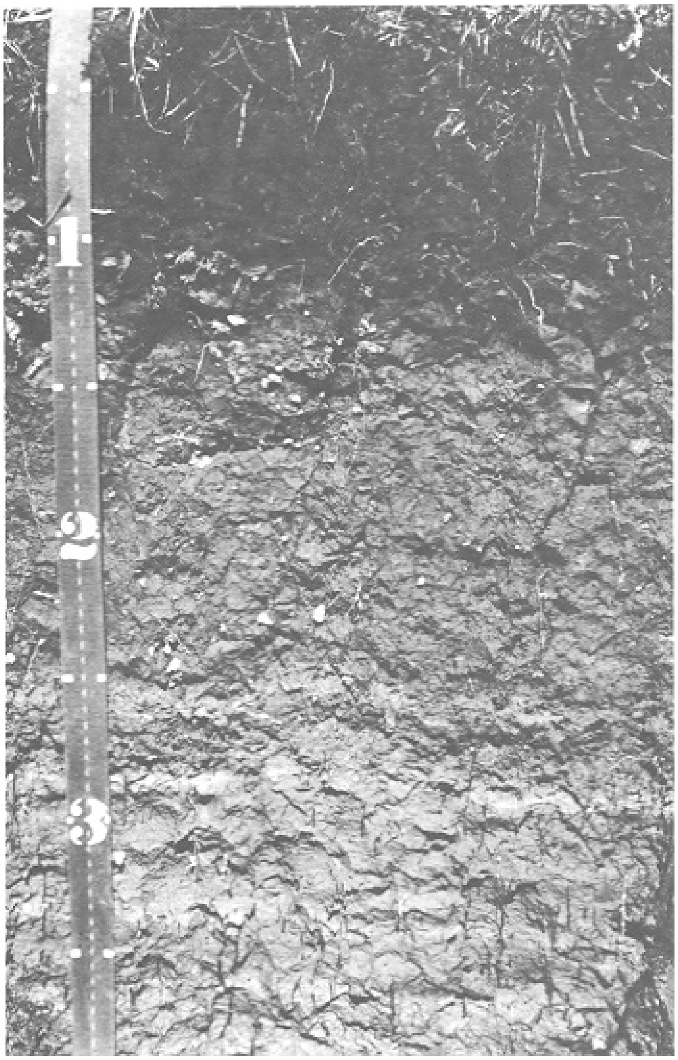

Figure 3.-A profile of Bossburg muck. This soil formed in alluvium from volcanic ash. The stratified layers are common to soils on alluvial bottom lands.

by maintaining the water table immediately below the root zone and allowing it to return to the surface during the nongrowing season. Minimum tillage helps to avoid compaction. The use of crop residue on and in the surface layer helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by annual grain for 2 years.

This soil is suited to rangeland. The native vegetation is mainly tufted hairgrass, redtop, and sedge Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing use should be carefully considered because wetness of the soil may limit access by livestock. Adapted grasses and legumes can be seeded to increase desirable forage if the range has deteriorated. However, special techniques are needed to establish satisfactory seedings.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding, wetness, and low strength. Buildings should be placed above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Drainage is needed if buildings are constructed. The design of buildings should offset the limited ability of the soil to support a load. The main limitations for septic tank absorption fields are the hazard of flooding and wetness.

This soil is in capability subclass IVw, nonirrigated.

38-Brickel stony loam, 20 to 60 percent slopes. This moderately deep, well drained soil is on upper side slopes and ridgetops of mountains. It formed in residuum, colluvium, and glacial till derived from granitic rock, with an admixture of volcanic ash and loess. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grass, forbs, shrubs, and scattered conifers. Elevation is 4,500 to 7,000 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 40° F. The frost-free season is 60 to 80 days.

Typically, the surface layer is dark brown and dark grayish brown stony loam about 16 inches thick. The subsoil is brown very stony fine sandy loam about 16 inches thick. The substratum is light yellowish brown extremely stony sandy loam about 6 inches thick. Fractured, fine-grained gneiss is at a depth of about 38 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Buhrig very stony loam, 40 to 65 percent slopes on convex, north- and east-facing side slopes
- Huckleberry silt loam, 40 to 65 percent slopes on north- and east-facing slopes in places of contact with shale
- Moscow silt loam, 40 to 65 percent slopes-on convex, south- and west-facing upper side slopes
- Vassar silt loam, 0 to 65 percent slopes-on convex, north- and east-facing upper side slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Brickel soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for rangeland. The main limitation is steepness of slope and stones on the surface in some areas. The native vegetation is mainly common beargrass, green fescue, sedge, black mountain huckleberry, and mountain ash. Overgrazing causes desirable plants, such as red fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Areas can be seeded by aerial application or by hand broadcasting.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. Excavations for building sites are limited by the moderate depth to bedrock. The main limitations for septic tank absorption fields are steepness of slope and the depth to rock. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIIe, nonirrigated.

39-Bridgeson silt loam. This very deep, poorly drained soil is on bottom lands and low stream terraces. It formed in mixed alluvium that included igneous material, lacustrine sediment, volcanic ash, and loess. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, sedges, rushes, and forbs. Elevation is 1,600 to 2,200 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 48° F. The frost-free season is 100 to 125 days.

Typically, the surface layer is gray silt loam about 10 inches thick. The underlying material is mottled, light gray heavy silt loam about 2 inches thick. It is underlain by mottled, light gray and gray silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of –

- Chewelah fine sandy loam, Narcisse silt loam, and Colville silt loam-on similar landscape positions
- Peone silt loam-in depressions and on bottom lands

The included areas make up about 20 percent of the total acreage.

The permeability of this Bridgeson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of .5 foot to 1.5 feet. This soil is subject to occasional flooding for long periods from February to April. Runoff is very slow.

This soil is used for nonirrigated crops and for rangeland.

The main limitations of this soil for the production of wheat, barley, oats, clover, and grass are the seasonal high water table and the hazard of flooding. I n wet years, spring planting may be delayed. Protective levees help to reduce flooding. Proper timing of minimum tillage helps to avoid compaction. Incorporating crop residue into the surface layer helps to maintain good tilth and conserve moisture. Tile drainage or open ditches can be used to remove excess water if a suitable outlet is available. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by annual grain for 2 years.

This soil is suited to rangeland. The native vegetation is mainly reed canarygrass, tufted hairgrass, redtop, sedge, and lupine. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing use should be carefully considered because wetness of the soil may limit access by livestock. Adapted grasses and legumes can be seeded to reduce erosion and to increase desirable forage in areas where the range has deteriorated or in recently disturbed areas. However, special techniques are needed to establish satisfactory seedings.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. The main limitations for septic tank absorption fields are the hazard of flooding, wetness, and moderately slow permeability. The high water table increases the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIIw, nonirrigated.

40-Bridgeson silt loam, drained. This very deep, artificially drained soil is on bottom lands. It formed in mixed alluvium that included igneous material, lacustrine sediment, volcanic ash, and loess. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, sedges, rushes, and forbs. The elevation is 1,600 to 2,200 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 48° F. The frost-free season is 100 to 125 days.

Typically, the surface layer is gray silt loam about 10 inches thick. The underlying material is mottled, light gray heavy silt loam about 2 inches thick. It is underlain by mottled, light gray and gray silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of Chewelah fine sandy loam, Narcisse silt loam, Colville silt loam, and Peone silt loam in depressions and on bottom lands. The included areas make up about 15 percent of the total acreage.

The permeability of this Bridgeson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet. This soil is subject to occasional flooding for long periods from February to April. Runoff is very slow. There is no hazard of water erosion.

This soil is used for nonirrigated crops.

The main limitations of this soil for the production of wheat, barley, oats, clover, and grass are wetness and the hazard of flooding. Tile drainage or open ditches can be used to remove excess water if outlets are available. Protective levees help to reduce flooding. Growing grass and legumes in rotation helps to maintain and improve tilth. Proper timing of minimum tillage helps to avoid compaction. Chiseling may be needed every few years to break tillage pans. Incorporating crop residue into the surface layer helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Drainage is needed if buildings are constructed on this soil. Dikes and channels can be used to protect homesites from being flooded. The main limitations for septic tank absorption fields are flooding, wetness, and moderately slow permeability. The high water table increases the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIw, nonirrigated.

41-Buhrig very stony loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on upper foot slopes and ridgetops of mountains. It formed in colluvium and residuum derived from metasedimentary and igneous rocks and is mantled with volcanic ash and loess. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is about 30 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The surface layer is grayish brown very stony loam about 4 inches thick. The upper part of the subsoil is yellowish brown extremely stony loam about 8 inches thick, and the lower part is light yellowish brown extremely stony sandy loam about 6 inches thick. The substratum is light yellowish brown extremely stony sandy loam about 4 inches thick. Fractured quartzite is at a depth of about 22 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Brickel stony loam, 20 to 60 percent slopes-on convex, mountain ridgetops
- Buhrig very stony loam, 40 to 65 percent slopes, and Huckleberry silt loam, 25 to 40 percent slopes-on convex foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave foot slopes
- poorly drained soils in drainageways and areas adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Buhrig soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. Grand fir, subalpine fir, and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 84 on the Buhrig soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 29 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 35 cubic feet per acre per year.

In winter, snowpack and steepness of slope hinder the use of equipment on this soil and limit access. Stones on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, grand fir, and subalpine fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock, steepness of slope, and large stones. Excavations for building sites are limited by the depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Stones may interfere with excavations. The main limitations for septic tank absorption fields are the depth to rock, steepness of slope, and large stones. Special design is needed because of the limited depth of soil over the bedrock. Stones can hinder the placement of absorption lines.

This soil is in capability subclass VIs, nonirrigated.

42-Buhrig very stony loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the upper side slopes of mountains (fig. 4). It formed in colluvium and residuum derived from metasedimentary and igneous rock and is mantled with volcanic ash and loess. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is about 30 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The surface layer is grayish brown very stony loam about 4 inches thick. The upper part of the subsoil is yellowish brown extremely stony loam about 8 inches thick, and the lower part is light yellowish brown extremely stony sandy loam about

Figure 4.-Buhrig very stony loam, 40 to 65 percent slopes, is near the vegetative timberline. Frost shattering creates large colluvial boulders and stones on the surface.

6 inches thick. The substratum is light yellowish brown extremely stony sandy loam 4 inches thick. Fractured quartzite is at a depth of about 22 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Brickel stony loam, 20 to 60 percent slopes-on convex, mountain ridgetops
- Buhrig very stony loam, 25 to 40 percent slopes, and Huckleberry silt loam, 40 to 65 percent slopes-on convex side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Buhrig soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to grand fir, subalpine fir, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 84 on the Buhrig soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 29 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 35 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. Stones on the surface can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, grand fir, and subalpine fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

In most areas of this soil, the native understory vegetation is mainly pachystima, pinegrass, dwarf huckleberry, currant, elk sedge, lupine, and arnica.

This soil is in capability subclass Vlls, nonirrigated.

43-Buhrig-Rock outcrop complex, 25 to 40 percent slopes. The soils in this complex are on the upper foot slopes and ridgetops of mountains. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is about 30 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days. This unit is about 65 percent Buhrig very stony loam, 25 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Brickel stony loam, 20 to 60 percent slopes-on convex, mountain ridgetops
- Huckleberry silt loam, 25 to 40 percent slopes-on convex foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave foot slopes
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- talus downslope from prominent Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Buhrig soil is moderately deep and well drained. It formed in colluvium and residuum weathered from metasedimentary and igneous rock and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The surface layer is grayish brown very stony loam about 4 inches thick. The upper part of the subsoil is yellowish brown extremely stony loam about 8 inches thick, and the lower part is light yellowish brown extremely stony sandy loam about 6 inches thick. The substratum is light yellowish brown extremely stony sandy loam about 4 inches thick. Fractured quartzite is at a depth of about 22 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Buhrig soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed quartzite or shale. Most areas are moderately steep or steep.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. Grand fir, subalpine fir, and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 84 on the Buhrig soil. The basal area is about 38 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 24 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 29 cubic feet per acre per year.

Outcrops of rock can cause breakage of timber and hinder yarding operations on these soils. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding and skidding paths converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, grand fir, and subalpine fir takes place naturally where seed trees are present. However, the high soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Rock outcrop limits the even distribution of reforestation. Areas also can be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

In most areas of these soils, the native understory vegetation is mainly pachystima, pinegrass, dwarf huckleberry, currant, elk sedge, lupine, and arnica.

These soils are poorly suited to homesite development. The main imitations are the moderate depth to bedrock, steepness of slope, large stones, and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by the depth to bedrock. Stones and Rock outcrop can hinder excavation. The main limitations for septic tank absorption felids are the depth to rock, large stones, and steepness o f slope. Special design is needed because of the limited depth of soil over the bedrock. Stones and Rock outcrop can hinder the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

44-Buhrig-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on the upper side slopes of mountains. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is about 30 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days. This unit is about 65 percent Buhrig very stony loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Brickel stony loam, 20 to 60 percent slopes-on convex, mountain ridgetops
- Huckleberry silt loam, 40 to 65 percent slopes-on convex side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave side slopes
- very shallow and very stony soils
- poorly drained soils in drainageways arid areas adjacent to seeps and springs
- talus downslope from prominent Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Buhrig soil is moderately deep and well drained. It formed in colluvium and residuum weathered from metasedimentary and igneous rock and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with an organic mat about 1 inch thick. The surface layer is grayish brown very stony loam about 4 inches thick. The upper part of the subsoil is yellowish brown extremely stony loam about 8 inches thick, and the lower part is light yellowish brown extremely stony sandy loam about 6 inches thick. The substratum is light yellowish brown extremely stony sandy loam about 4 inches thick. Fractured quartzite is at a depth of about 22 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Buhrig soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed quartzite or shale. Most areas are steep or very steep.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to grand fir, subalpine fir, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 84 on the Buhrig soil. The basal area is about 38 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 24 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 29 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slopes and Rock outcrop. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. Outcrops of rock can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, grand fir, and subalpine fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Rock outcrop limits the even distribution of reforestation. Areas also can be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

In most areas of these soils the native understory vegetation is mainly pachystima, pinegrass, dwarf huckleberry, currant, elk sedge, lupine, and arnica.

The soils in this complex are in capability subclass VIIs, nonirrigated.

45-Cedonia silt loam, 0 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The subsoil is light gray silt loam about 24 inches thick. The substratum is light gray silt loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are small areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, Hunters silt loam, 0 to 5 percent slopes, and Koerling fine sandy loam, 0 to 5 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes, and Bisbee loamy fine sand, 0 to 15 percent slopes-on dunelike terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Cedonia soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for nonirrigated and irrigated crops. A few areas are used for grazeable woodland.

This soil is well suited to the production of nonirrigated wheat, barley, alfalfa, and grasses. It has few limitations. The soil can be cropped to grain annually. Grassed waterways help to control water erosion caused by concentrated flow. Crop residue incorporated into the surface layer helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is annual grain, or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay crops. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is suited to the production of ponderosa pine. Douglas-fir, lodgepole pine, and western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 113 on the Cedonia soil. The basal area is about 58 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 74 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying, Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, lupine, common snowberry, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted legumes and grasses may be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is well suited to homesite development. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass IIe, irrigated, and IIc, nonirrigated.

46-Cedonia silt loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The subsoil is light gray silt loam about 24 inches thick. The substratum is light gray silt loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are small areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Koerling fine sandy loam, 5 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 0 to 5 percent slopes, Cedonia silt loam, 5 to 25 percent slopes, eroded, and Bisbee loamy fine sand, 0 to 15 percent slopes on dunelike terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Cedonia soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated and irrigated crops. A few areas are used for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 or 3 years followed by alfalfa and grass for 4 to 8 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay crops. The main limitations are the hazard of erosion and steepness of slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 113 on the Cedonia soil. The basal area is about 58 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 74 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Fuddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control Erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, lupine, common snowberry, and spirea. Overgrazing causes desirable plants, such a:,, pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is capability subclass IIIe, nonirrigated and irrigated.

47-Cedonia silt loam, 5 to 25 percent slopes, eroded. This very deep, well drained soil is on undulating terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is light brownish gray silt loam about 2 inches thick. The subsoil is light gray silt loam about 20 inches thick. The substratum is light gray silt loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are small areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Koerling fine sandy loam, 5 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 0 to 5 percent slopes, Cedonia silt loam, 5 to 15 percent slopes, and Bisbee loamy fine sand, 0 to 15 percent slopes-on dunelike terraces

The included areas make up about 30 percent of the total acreage.

The permeability of this Cedonia soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated crops. A few areas are used for grazeable woodland.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses are steepness of slope and the hazard of water erosion. Minimum tillage, early seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa-grass for 4 to 8 years followed by annual grain for 2 years.

This soil is well suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 113 on the Cedonia soil. The basal area is about 58 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The mean annual increment at 40 years of trees 0.6 inch dbh and larger is 74 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, lupine, common snowberry, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability. Absorption lines should be installed on the contour.

This soil is in capability subclass IVe, nonirrigated.

48-Cedonia silt loam, 15 to 30 percent slopes. This very deep, well drained soil is on terraces and terrace escarpments. It formed in glacial lake sediment and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The subsoil is light gray silt loam about 24 inches thick. The substratum is light gray silt loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are small areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Koerling fine sandy loam, 5 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes, Cedonia silt loam, 5 to 25 percent slopes, eroded, Bisbee loamy fine sand, 25 to 45 percent slopes, and Hagen sandy loam, 15 to 40 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Cedonia soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated crops. A few areas are used for grazeable woodland.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses are steepness of slope and the hazard of water erosion. Minimum tillage, early seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the main draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 years.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 113 on the Cedonia soil. The basal area is about 58 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 74 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment helps to reduce soil damage and maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir take place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, lupine, common snowberry, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability.

This soil is in capability subclass IVe, nonirrigated.

49-Cedonia silt loam, 30 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in glacial lake sediment and is mantled with volcanic ash and loess (fig. 5). Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The subsoil is light gray silt loam about 24 inches thick. The substratum is light gray

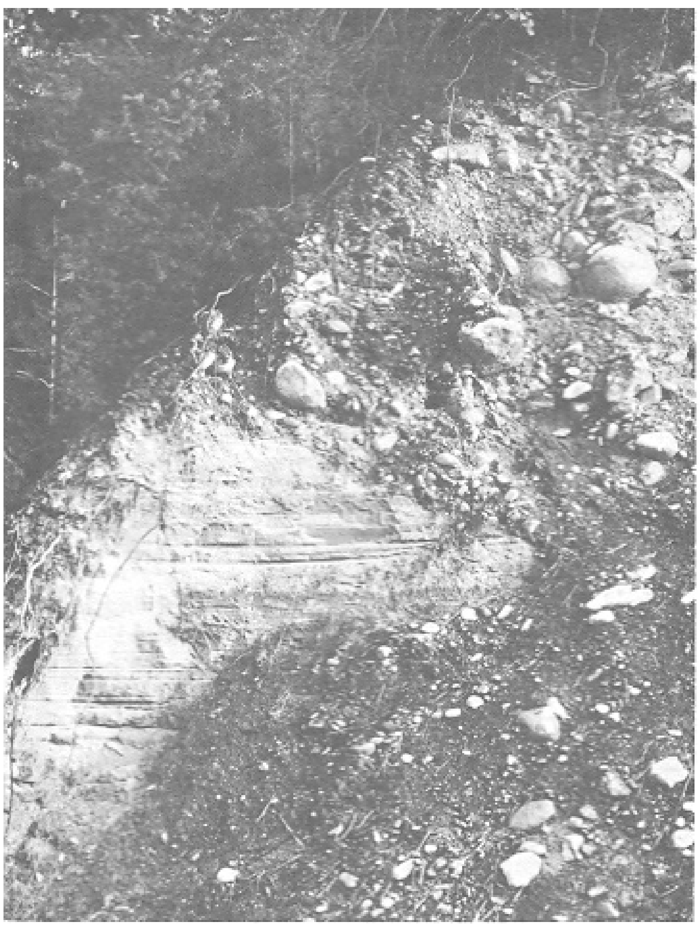

Figure 5.-Cedonia silt loam, 30 to 65 percent slopes, is on the left, and Dehart cobbly loam, 40 to 65 percent slopes, is on the right. The Cedonia soils formed in glacial lake sediment, and the Dehart soils formed in glacial drift. The contrasting contact line is between the! Soils.

silt loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous. Included with this soil in mapping are small areas of-

- Hagen sandy loam, 15 to 40 percent slopes, Koerling fine sandy loam, 30 to 65 percent slopes, and Bisbee loamy fine sand, 25 to 45 percent slopes-on similar landscape positions
- Cedonia silt loam, 15 to 30 percent slopes, and Cedonia silt loam, 5 to 25 percent slopes, eroded-on undulating terraces

The included areas make up about 20 percent of the total acreage.

The permeability of this Cedonia soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 113 on the Cedonia soil. The basal area is about 58 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 74 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is used for grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, lupine, common snowberry, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

50-Chamokane gravelly sandy loam. This very deep, somewhat poorly drained soil is in bottom lands. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface layer is brown gravelly sandy loam about 16 inches thick. The upper part of the underlying material is mottled, light gray loam about 12 inches thick. The lower part is multicolored, stratified gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Chewelah fine sandy loam and Narcisse silt loam-on similar landscape positions
- Colville silt loam-on alluvial bottom lands
- Kegel loam-on low alluvial terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Chamokane soil is moderate to the gravelly loamy sand underlying material and very rapid through it. The available water capacity is high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet during the months of January to April. Many areas of this soil are subject to occasional flooding for a brief period during the months of February to May. Runoff is very slow. There is no hazard of water erosion.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western redcedar, Engelmann spruce, lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 118 on the Chamokane soil The basal area is about 80 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 96 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 110 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is seasonal wetness. A seasonal high water table restricts the use of equipment to midsummer or midwinter months when the soil is dry or frozen.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Roads need ballast for year-round use.

The reforestation of cutover areas by Douglas-fir, Engelmann spruce, lodgepole pine, and grand fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances for seedling survival. Survival of seedlings also may be poor in areas where flooding occurs. The seasonal high water table restricts root development. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly sedges and pinegrass. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

Some areas of this soil are used for the production of nonirrigated wheat, barley, oats, clover, alfalfa, and grasses. The main limitation is wetness. Protective levees help in control of flooding. Tile drainage or open ditches can be used to lower the water table if a suitable outlet is available. Incorporating crop residue into the surface layer helps to maintain good tilth and conserve moisture. The proper timing of minimum tillage helps to avoid compaction. The gravel content in this soil can interfere with tillage operations and reduce the available water capacity. A suitable crop rotation is clover and grass for 4 to 8 years followed by annual grain for 2 to 3 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. In addition, cutbanks are not stable and are subject to caving. Drainage is needed if buildings are constructed on this soil. Dikes and channels can be used to protect homesites from being flooded. The main limitations for septic tank absorption fields are flooding, wetness, and very rapid permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIw, nonirrigated.

51-Chamokane loam. This very deep, somewhat poorly drained soil is in bottom lands. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface layer is brown loam about 16 inches thick. The upper part of the underlying material is mottled, light gray loam about 12 inches thick. The lower part is multicolored, stratified gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Chewelah fine sandy loam and Narcisse silt loam-on similar landscape positions

- Colville silt loam-on bottom lands
- Kegel loam-on low alluvial terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Chamokane soil is moderate to the gravelly loamy sand layer and very rapid through it. The available water capacity is high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet during the months of January to April. Channeling and deposition are common along streambanks. Runoff is very slow. There is no hazard of water erosion, or it is slight. Many areas of this soil are subject to occasional flooding for a brief period during the months of February to May.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western redcedar, Engelmann spruce, lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 118 on the Chamokane soil. The basal area is about 80 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 96 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 110 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is seasonal wetness. A seasonal high water table restricts equipment to midsummer or midwinter months when the soil is dry or frozen. Using standard wheeled and tracked equipment causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Roads need ballast for year-round use.

The reforestation of cutover areas by Douglas-fir, Engelmann spruce, lodgepole pine, and grand fir takes place naturally where seed trees are present. However, survival of seedlings may be poor in areas where flooding occurs. The seasonal high water table restricts root development. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas can also be reforested by the planting of Douglas-fir, grand fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly sedges and pinegrass. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, clover, alfalfa, and grass is seasonal wetness. Protective levees help to control flooding. Tile drainage or open ditches can be used to lower the water table if a suitable outlet is available. The proper timing of minimum tillage helps to avoid compaction. Incorporating crop residue into the surface layer helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. Cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are flooding, wetness, and very rapid permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIw, nonirrigated.

52-Cheney silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash material and is mantled with volcanic ash and loess. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 2,500 feet. The average precipitation is about 16 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 130 days.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is yellowish brown gravelly loam about 14 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of Bong sandy loam, 0 to 15 percent slopes; Dart loamy coarse sand, 0 to 8 percent slopes; Hesseltine silt loam, 0 to 8 percent slopes; Springdale sandy loam, 0 to 15 percent slopes, and Marble loamy sand, 5 to 25 percent slopes. The soils are on similar landscape positions. The included areas make up about 15 percent of the total acreage.

The permeability of this Cheney soil is moderate to the substratum and very rapid through it. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated crops and as rangeland.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early seeding of winter grain, and cross slope chiseling help to control sheet and rill erosion. In the major draws and waterways, minimum tillage and grassed waterways can help to control erosion from concentrated flow. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to control erosion on nonirrigated cropland. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

This soil is suited to rangeland. The native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum, which can result in seepage.

This soil is in capability subclass IIIe, nonirrigated.

53-Cheney stony silt loam, 5 to 25 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash material and is mantled with volcanic ash and loess. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 2,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 130 days.

Typically, the surface layer is dark grayish brown stony silt loam about 10 inches thick. The subsoil is yellowish brown gravelly loam about 14 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bong sandy loam, 0 to 15 percent slopes, Cheney silt loam, 0 to 15 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Hesseltine silt loam, 0 to 8 percent slopes, and Springdale sandy loam-on terraces
- Marble loamy sand, 5 to 25 percent slopes-on terraces that have dunelike relief

The included areas make up about 15 percent of the total acreage.

The permeability of this Cheney soil is moderate to the substratum and very rapid through it. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for rangeland. The native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and very rapid permeability in the substratum. Absorption lines should be installed on the contour. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIe, nonirrigated.

54-Cheney stony silt loam, 25 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in glacial outwash material and is mantled with volcanic ash and loess. Slopes are concave. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 2,500 feet. The average annual precipitation is about 47° F. The frost-free season is 100 to 130 days.

Typically, the surface layer is dark grayish brown stony silt loam about 10 inches thick. The subsoil is yellowish brown gravelly loam about 14 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bong sandy loam, 15 to 25 percent slopes, Cheney stony silt loam, 5 to 25 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Hesseltine silt loam, 0 to 8 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes on terraces
- Marble loamy sand, 5 to 25 percent slopes-on terraces that have dunelike relief

The included areas make up about 20 percent of the total acreage.

The permeability of this Cheney soil is moderate to the substratum and very rapid through it. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Areas can be seeded by aerial application or by hand broadcasting.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and very rapid permeability in the substratum. The contamination of ground water as a result of seepage is a possibility. This soil is in capability subclass VIIe, nonirrigated.

55-Chewelah fine sandy loam. This very deep, somewhat poorly drained soil is on alluvial terraces. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, and shrubs. Elevation is 1,500 to 2,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 125 days.

Typically, the surface layer is dark gray and dark grayish brown fine sandy loam about 18 inches thick. The upper part of the underlying material is mottled, light brownish gray fine sandy loam about 14 inches thick. The lower part is mottled, brown loamy sand about 5 inches thick. Below that is multicolored coarse sand to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Bridgeson silt loam-on similar landscape positions
- Chamokane loam, Colville silt loam, and Narcisse silt loam-on bottom lands

The included areas make up about 20 percent of the total acreage.

The permeability of this Chewelah soil is moderate to the loamy sand layer and very rapid through it. The available water capacity is high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet during the months of February to May. Runoff is very slow, and there is no hazard of erosion. Many areas are subject to occasional flooding for brief periods during the months of February to May. Channeling and deposition are common along streambanks. The hazard of wind erosion is high.

This soil is used for nonirrigated and irrigated crops and for rangeland.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, clover, alfalfa, and grass are seasonal wetness and the hazards of wind erosion and flooding. Using tile and open drainage systems, cleaning out the channels, and installing protective levees help to control flooding and lower the water table. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on non irrigated cropland. Grass and legumes planted in rotation also provide excellent wind erosion control. A suitable crop rotation on this soil is clover and grass for 4 to 8 years and annual grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients. In summer, irrigation is required for the maximum production of most crops.

This soil is suited to rangeland. In most areas, the native vegetation is mainly tufted hairgrass, redtop, and sedge. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing use should be carefully considered because wetness of the soil may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. However, special techniques are needed for reseeding.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings, roads, and streets should be located above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. Cutbanks are unstable and are subject to caving. The main limitations for septic tank absorption fields are flooding, wetness, and very rapid permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

56-Clayton fine sandy loam, 0 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in mixed glaciofluvial sediment. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,000 feet. The average annual precipitation is about 23 inches, and the average annual air temperature is about 45° F. The frost-free season is 110 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown fine sandy loam about 11 inches thick, and the lower part is light yellowish brown fine sandy loam about 11 inches thick. The upper part of the substratum is pale brown fine sandy loam about 14 inches thick. The lower part of the substratum is light yellowish brown loamy fine sand to a depth of 60 inches or more. The substratum has a few brown loam bands 1/8 inch in thickness.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, and Eloika silt loam, 0 to 15 percent slopes-on outwash terraces
- Clayton fine sandy loam, 5 to 15 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Phoebe sandy loam, 0 to 5 percent slopes-on higher terraces
- Laketon silt loam, 0 to 5 percent slopes-on lakebed terrace remnants
- Wethey loamy sand and Wolfeson very fine sandy loam-in depressions adjacent to stream channels

The included areas make up about 15 percent of the total acreage.

The permeability of this Clayton soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight to moderate, and the hazard of wind erosion is high.

This soil is used for nonirrigated and irrigated crops and for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grasses is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes in rotation also provide excellent wind erosion control. Grassed waterways help to control eater erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is well suited to the production of Douglas-fir. It is also suited ponderosa pine, western larch, lodgepole pine, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 101 on the Clayton soil. The basal area is about 76 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 79 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, western larch, and western white pine takes place naturally where seed trees are present. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. Areas also can be reforested by the planting of Douglas-fir, western white pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, strawberry, Oregon-grape, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be reseeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is well suited to homesite development. Cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is moderate permeability. Using sandy backfill and long absorption lines help to compensate for this restriction.

This soil is in capability subclass IIe, nonirrigated and irrigated.

57-Clayton fine sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in mixed glaciofluvial sediment. Surfaces are planar. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,000 feet. The average annual precipitation is about 23 inches, and the average annual air temperature is 45° F. The frost-free season is 110 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown fine sandy loam about 7 inches thick, and the lower part is light yellowish brown fine sandy loam about 11 inches thick. The upper part of the substratum is pale brown fine sandy loam about 14 inches thick. The lower part of the substratum is light yellowish brown loamy fine sand to a depth of 60 inches or more. The substratum has a few brown loam bands 1/8 inch in thickness.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, and Eloika silt loam, 0 to 15 percent slopes-on terraces
- Clayton fine sandy loam, 0 to 5 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Phoebe sandy loam, 5 to 15 percent slopes-on higher terraces
- Laketon silt loam, 5 to 15 percent slopes-on lakebed terrace remnants
- Wethey loamy sand and Wolfeson very fine sandy loam-in depressions adjacent to stream channels

The included areas make up about 20 percent of the total acreage.

The permeability of this Clayton soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is high.

This soil is used for nonirrigated and irrigated crops, and for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grasses is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. The use of crop residue helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. Divided slope farming, stripcropping, diversions, or terraces and grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. The main limitations are the hazards of wind and water erosion and steepness of slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, lodgepole pine, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 101 on the Clayton soil. The basal area is about 76 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 79 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, western larch, and western white pine takes place naturally where seed trees are present. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. Areas also can be reforested by the planting of Douglas-fir, western white pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, strawberry, Oregon-grape, and spirea. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be reseeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development The main limitation is slope. Special design of buildings is needed to overcome this limitation. Cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and moderate permeability. Absorption lines should be installed on the contour. Using sandy backfill and long absorption lines help to compensate for the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

58-Colville silt loam. This very deep, poorly drained soil is in bottom lands. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, and shrubs. Elevation is 1,400 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 100 to 125 days.

Typically, the surface layer is dark gray, calcareous silt loam 17 inches thick. The subsoil is mottled, gray, calcareous silty clay loam 10 inches thick. The upper part of the substratum is mottled, light gray, calcareous silty clay loam 27 inches thick. The lower part of the substratum is mottled, white silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of-

- Bridgeson silt loam and Chewelah fine sandy loam-on higher terraces
- Peone silt loam and Konner silty clay loam-in depressions and on bottom lands
- Saltese muck-in basins adjacent to lakes and streams

The included areas make up about 20 percent of the total acreage.

The permeability of this Colville soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at or near the surface to a depth of 1.5 feet during the months of February to June. Runoff is very slow. There is no hazard of water erosion. This soil is subject to occasional flooding for long periods during the months of February to May. Channeling and deposition are common along the streambanks.

This soil is used as rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly basin wildrye, saltgrass, and alkali cordgrass. Overgrazing causes desirable plants, such as basin wildrye and alkali cordgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of wheat, barley, oats, clover, and grasses are the seasonal high water table and flooding. In wet years, spring planting can be delayed. Protective levees and drainage systems help to reduce flooding and lower the water table. The proper timing of minimum tillage helps to avoid compaction. Incorporating crop residue into the surface layer helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by annual grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients. In summer, irrigation is needed for the maximum production of most crops.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. The main limitations for septic tank absorption fields are flooding, wetness, and moderately slow permeability. The high water table and the restricted permeability increase the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IVw, nonirrigated and irrigated.

59-Colville silt loam, drained. This very deep, artificially drained soil is in bottom lands. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, and shrubs. Elevation is 1,400 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 100 to 125 days.

Typically, the surface layer is dark gray, calcareous silt loam about 17 inches thick. The subsoil is mottled, gray, calcareous silty clay loam about 10 inches thick. The upper part of the substratum is mottled, light gray, calcareous silty clay loam about 27 inches thick. The lower part of the substratum is mottled, white silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of-

- Bridgeson silt loam-on similar landscape positions
- Chewelah fine sandy loam-on higher terraces
- Peone silt loam and Konner silty clay loam-in depressions and on bottom lands
- Saltese muck-in basins adjacent to lakes and streams

The included areas make up about 20 percent of the total acreage.

The permeability of this Colville soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet during the months of February to June. Runoff is very slow, and there is no hazard of water erosion. This soil is subject to occasional flooding for long periods during the months of February to May. Channeling and deposition are common along the streambanks.

This soil is used for nonirrigated and irrigated crops.

The main limitations of this soil for the production of wheat, barley, oats, clover, alfalfa, and grass are the seasonal high water table and flooding. In wet years, spring planting can be delayed. Protective levees and drainage systems help to control flooding and lower the seasonal high water table. The proper timing of minimum tillage helps to avoid compaction. Using crop residue helps to maintain good tilth and conserve moisture. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

Sprinkler irrigation, where water is available, increases yields. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. The main limitations for septic tank absorption fields are flooding, wetness, and moderately slow permeability. The high water table and restricted permeability increase the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IIIw, nonirrigated and irrigated.

60-Dart loamy coarse sand, 0 to 8 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in mixed sandy alluvium. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is pale brown loamy coarse sand about 2 inches thick. The subsoil is very pale brown and pale brown loamy coarse sand about 12 inches thick. The substratum is light brownish gray coarse sand about 7 inches thick. Below that is multicolored sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Springdale sandy loam, 0 to 15 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Hardesty silt loam-on alluvial fans and in depressions
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Dart soil is rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very slow. There is no hazard of water erosion, but the hazard of wind erosion is high.

This soil is used for grazeable woodland. A few areas are used for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 83 on the Dart soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 53 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is the loose, sandy surface layer. Using standard wheeled and tracked equipment causes rutting and surface displacement when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. in most areas, the native understory vegetation is mainly bluebunch wheatgrass, needlegrass, Sandberg bluegrass, and prairie junegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and prairie junegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated alfalfa, grass, and wheat are the hazard of wind erosion and low available water capacity. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is well suited to homesite development. It has slight limitations. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IVe, nonirrigated and irrigated.

61-Dearyton silt loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on toe slopes of plateaus and foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 2,800 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 120 to 135 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown silt loam about 6 inches thick. The subsoil is pale brown silt loam about 15 inches thick that is underlain by a buried, light gray loam subsurface horizon about 6 inches thick. Below that is a buried, light brown silty clay and gravelly silty clay subsoil to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 0 to 15 percent slopes-on toe slopes
- Green Bluff silt loam, 0 to 5 percent slopes-on basalt plateaus
- Donavan loam, 0 to 8 percent slopes- on south and west-facing slopes
- poorly drained soils in depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Dearyton soil is moderate to the subsoil and slow through it. The available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. A perched water table is at a depth of 18 to 30 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 85 on the Dearyton soil. The basal area is about 74 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 47 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of natural reforestation. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. The silty clay subsoil restricts the penetration of roots. This restriction limits the growth of trees and increases the hazard of windthrow. Areas also can be reforested by the planting by Douglas-fir, lodgepole pine, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, lupine, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. A suitable crop rotation on this soil is annual grain or a 3-year rotation oil winter wheat, spring grain, and summer fallow for weed control.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is wetness. Proper timing of minimum tillage helps to avoid compaction. Retaining sufficient amounts of crop residue on the surface and incorporating it into the surface layer helps to maintain good tilth, conserve moisture, and control erosion. Tile drainage or open ditches can be used to lower the water table if outlets are available.

This soil is poorly suited to homesite development. The main limitation is the shrink-swell potential. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from the building help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass IIw, nonirrigated.

62-Dearyton silt loam, 5 to 15 percent slopes. This very deep, moderately well drained soil is on toe slopes of plateaus and foothills. It formed in glacial till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 2,800 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 120 to 135 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown silt loam about 6 inches thick. The subsoil is pale brown silt loam about 15 inches thick that is underlain by a subsurface layer of light gray brown about 6 inches thick. Below that is a buried, light brown silty clay and gravelly silty clay subsoil to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 0 to 15 percent slopes-on toe slopes
- Green Bluff silt loam, 5 to 15 percent slopes-on basalt plateaus
- Donavan loam, 8 to 25 percent slopes-on south and west-facing slopes
- poorly drained soils in depressions
- soils that have slopes of as much as 40 percent.

The included areas make up about 20 percent of the total acreage.

The permeability of this Dearyton soil is moderate to the subsoil and slow through it. The available water capacity is very high. The rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 18 to 30 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 85 on the Dearyton soil. The basal area is about 74 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 47 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of natural reforestation. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. The silty clay subsoil restricts the penetration of roots. This restriction limits the growth of trees and increases the hazard of windthrow. Areas also can be reforested by the planting of Douglas-fir, lodgepole pine, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, lupine, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitation is the shrink-swell potential. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass IIIe, nonirrigated.

63-Dehart gravelly sandy loam, 15 to 25 percent slopes. This very deep, somewhat excessively drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown gravelly sandy loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 15 to 20 percent slopes, and Donavan loam, 8 to 25 percent slopes.-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on terraces
- Raisio shaly loam, 20 to 40 percent slopes-on convex foot slopes
- Stevens channery silt loam, 8 to 25 percent slopes-on concave slopes
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. However, small areas are cleared and used for nonirrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally if seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope, the hazard of water erosion, and low available water capacity. Minimum tillage, early fall seeding, and cross slope fall tillage help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and large stones. Special design of buildings is needed to overcome the limitation imposed by slope. Cobbles and stones can hinder excavations. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope, large stones, and rapid permeability in the substratum. Stones may hinder the placement of absorption lines. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IVe, nonirrigated.

64-Dehart gravelly sandy loam, 25 to 40 percent slopes. This very deep, somewhat excessively drained soil is on foot slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown gravelly sandy loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on similar landscape positions
- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Maki gravelly loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Cedonia silt loam, 5 to 15 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on terrace remnants
- Stevens channery silt loam, 25 to 40 percent slopes-on concave slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and large stones. Special design of buildings is needed to overcome the limitation imposed by slope. Cobbles and stones can hinder excavations. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope, large stones, and rapid permeability in the substratum. Stones may hinder the placement of absorption lines. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIe, nonirrigated.

65-Dehart gravelly sandy loam, 40 to 65 percent slopes. This very deep, somewhat excessively drained soil is on the side slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown gravelly sandy loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 40 to 65 percent slopes, and Donavan loam, 40 to 65 percent slopes-on similar landscape positions
- Cedonia silt loam, 15 to 30 percent slopes, and Spens extremely gravelly loamy sand, 30 to 65 percent slopes-on terraces and terrace escarpments
- Maki gravelly loam, 40 to 65 percent slopes, and Raisio shaly loam, 40 to 65 percent slopes-on convex, upper side slopes
- Stevens stony silt loam, 40 to 60 percent slopes on concave slopes
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is, very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads or trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

66-Dehart cobbly loam, 5 to 20 percent slopes. This very deep, somewhat excessively drained soil is on toe slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of loess and volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown cobbly loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan stony loam, 0 to 30 percent slopes-on similar landscape positions
- Aits stony loam, 0 to 40 percent slopes-on north and eases facing slopes
- Cedonia silt loam, 5 to 15 percent slopes, and Springdale gravelly sandy loam, 0 to 10 percent slopes
- Hardesty silt loam-in basins in alluvial fans
- Stevens stony silt loam, 0 to 40 percent slopes on concave slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas can also be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and redstem ceanothus Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is large stones. Cobbles and stones can hinder excavations. Special design of buildings is needed to overcome the limitation imposed by slope. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are rapid permeability in the substratum and large stones. The contamination of ground water supplies as a result of seepage is a possibility. Stones can hinder the placement of absorption lines.

This soil is in capability subclass Vle, nonirrigated.

67-Dehart cobbly loam, 20 to 40 percent slopes. This very deep, somewhat excessively drained soil is on foot slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of loess and volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown cobbly loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan stony loam, 20 to 40 percent slopes-on similar landscape positions
- Aits stony loam, 0 to 40 percent slopes-on north and east-facing slopes
- Cedonia silt loam, 15 to 30 percent slopes, and Spens extremely gravelly loamy sand, 30 to 65 percent slopes-on terraces and terrace escarpments
- Raisio shaly loam, 20 to 40 percent slopes-on convex foot slopes
- Rufus shaly loam, 30 to 65 percent slopes, and Stevens stony silt loam, 0 to 40 percent slopes on concave slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The use of equipment with wheels or tracks causes ruts, soil compaction, and damage to tree roots when this soil is wet.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and redstem ceanothus. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and large stones. Special design of buildings is needed to overcome the limitation imposed by slope. Cobbles and stones can hinder excavations. In addition, cutbanks are not stables and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope, large stones, and rapid permeability in the substratum. Stones may hinder the placement of absorption lines. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass Vle, nonirrigated.

68-Dehart cobbly loam, 40 to 65 percent slopes. This very deep, somewhat excessively drained soil is on side slopes of foothills. It formed in glacial till and colluvium derived from metasedimentary rock, with an admixture of loess and volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown cobbly loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan stony loam, 30 to 65 percent slopes-on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Cedonia silt loam, 30 to 65 percent slopes, and Spens extremely gravelly loamy sand, 30 to 65 percent slopes-on terraces and terrace escarpments
- Raisio shaly loam, 40 to 65 percent slopes, and Scoap gravelly loam, 40 to 65 percent slopes-on convex slopes
- Rufus shaly loam, 30 to 65 percent slopes-on ridgetops
- Stevens stony silt loam, 40 to 65 percent slopes-on concave slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Dehart soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 50 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of wheeled and tracked equipment in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, and redstem ceanothus. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase.

The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

69-Dehart-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,500 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days. This unit is about 65 percent Dehart cobbly loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Donavan stony loam, 30 to 65 percent slopes-on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes-on north- and east-facing slopes

- Cedonia silt loam, 30 to 65 percent slopes, and Spens extremely gravelly loamy sand, 30 to 65 percent slopes-on terrace escarpments
- Raisio shaly loam, 40 to 65 percent slopes-on convex slopes
- Rufus shaly loam, 30 to 65 percent slopes-on ridgetops
- very stony and very shallow soils

The included areas make up about 15 percent of the total acreage.

The Dehart soil is very deep and somewhat excessively drained. It formed in glacial till arid colluvium, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown cobbly loam about 6 inches thick. The upper part of the subsoil is pale brown very cobbly sandy loam about 5 inches thick, and the lower part is pale brown extremely stony sandy loam about 19 inches thick. The substratum is pale brown extremely stony sandy loam to a depth of 60 inches or more.

The permeability of the Dehart soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed quartzite and shale on ridges and knobs. Most areas ere steep or very steep.

The soils of this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. Douglas-fir also grows on these soils.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Dehart soil. The basal area is about 38 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. The steep slopes restrict the use of equipment with wheels or tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations seduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Rock outcrop limits the even distribution of reforestation. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and redstem ceanothus. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase.

The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIls, nonirrigated.

70-Donavan loam, 0 to 8 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in mixed glacial till, with an admixture of volcanic ash and loess. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 15 to 25 percent slopes, Donavan loam, 8 to 25 percent slopes, and Spokane loam, 0 to 25 percent slopes-on toe slopes
- Stevens silt loam, 8 to 15 percent slopes-on concave toe slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

Using standard equipment with wheels and tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide valuable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

This soil is well suited to homesite development.

This soil is in capability subclass IIe, nonirrigated.

71-Donavan loam, 8 to 25 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills (fig. 6). It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is grasses, shrubs, forbs, and conifers. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Raisio shaly loam, 20 to 40 percent slopes, Rufus shaly loam, 30 to 65 percent slopes, Spokane loam, 25 to 40 percent slopes, and Skanid loam, 25 to 40 percent slopes-on convex, upper slopes
- Stevens silt loam, 8 to 15 percent slopes-on concave toe slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

Figure 6.-Donavan loam, 8 to 25 percent slopes, is on uplands in the foreground, and Colville silt loam is in the valley bottom. Spokane-Rock outcrop complex, 40 to 65 percent slopes, is on the mountain slopes in the distance.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide valuable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope. Absorption lines should be installed on the contour.

This soil is in capability subclass IVe, nonirrigated.

72-Donavan loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and, west. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Donavan loam, 40 to 65 percent slopes-on convex, upper side slopes
- Raisio shaly loam, 40 to 65 percent slopes, Rufus shaly loam, 30 to 65 percent slopes, Spokane loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on convex, upper slopes
- Stevens silt loam, 8 to 15 percent slopes-on concave toe slopes

The included areas make up about 20 per gent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

Using standard equipment with wheels or Cracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control Erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass VIe, nonirrigated.

73-Donavan loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes-on convex side slopes
- Donavan loam, 25 to 40 percent slopes-on convex, lower foot slopes
- Raisio shaly loam, 40 to 65 percent slopes, and Rufus shaly loam, 30 to 65 percent slopes-on side slopes and ridgetops
- Spokane loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on side slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave foot slopes

The included areas make up about 25 percent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at

80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage

This soil is in capability subclass VIIe, nonirrigated.

74-Donavan stony loam, 0 to 30 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in mixed glacial till, with an admixture of volcanic ash and loess. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about I inch thick. The upper part of the surface layer is grayish brown stony loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes-on convex foot slopes
- Donavan loam, 8 to 25 percent slopes-on concave toe slopes
- Raisio shaly loam, 40 to 65 percent slopes, and Rufus shaly loam, 30 to 65 percent slopes-on convex, upper side slopes
- Spokane loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on convex, upper side slopes in places of granitic contact
- Stevens channery silt loam, 25 to 40 percent slopes-on concave foot slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope. Absorption lines should be installed on the contour.

This soil is in capability subclass VIe, nonirrigated.

75-Donavan stony loam, 30 to 65 percent slopes. This very deep, well drained soil is on foot slopes and side slopes of foothills. It formed in mixed glacial till, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown stony loam about 6 inches thick, and the lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes-on convex foot slopes
- Donavan stony loam, 0 to 30 percent slopes-on convex, lower slopes
- Raisio shaly loam, 40 to 65 percent slopes, Rufus shaly loam, 30 to 65 percent slopes, Spokane stony loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on convex, upper side slopes
- Stevens stony silt loam, 0 to 40 percent slopes-on concave, lower slopes

The included areas make up about 25 percent of the total acreage.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 53 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The steep slopes restrict the use of wheeled and tracked equipment in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The proper location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

76-Donavan-Rock outcrop complex, 0 to 30 percent slopes. The soils in this complex are on toe slopes and foot slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46° F. The frost-free season is about 90 to 120 days. This unit is about 65 percent Donavan stony loam, 0 to 30 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes-on convex slopes
- Donavan loam, 8 to 25 percent slopes-on convex foot slopes
- Raisio shaly loam, 40 to 65 percent slopes, Rufus shaly loam, 30 to 65 percent slopes, Spokane stony loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on upper slopes
- Stevens channery silt loam, 8 to 25 percent slopes-on concave, lower toe slopes
- very shallow and very stony soils

The included areas make up about 15 percent of the total acreage.

The Donavan soil is very deep and well drained. It formed in mixed glacial till, with an admixture of volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown stony loam about 6 inches thick. The lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed quartzite or shale. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. They are also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 42 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 42 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 49 cubic feet per acre per year.

Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding and skidding paths are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are hindered by Rock outcrop. The main limitations for septic tank absorption fields are slope and Rock outcrop. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

77-Donavan-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on foot slopes and side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses.

Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days. This unit is about 65 percent Donavan stony loam, 30 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Donavan loam, 40 to 65 percent slopes-on similar landscape positions
- Dehart cobbly loam, 40 to 65 percent slopes-on convex slopes
- Raisio shaly loam, 40 to 65 percent slopes, Rufus shaly loam, 30 to 65 percent slopes, Spokane stony loam, 40 to 65 percent slopes, and Skanid loam, 40 to 65 percent slopes-on convex, upper slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, lower slopes
- very shallow and very stony soils

The included areas make up about 15 percent of the total acreage.

The Donavan soil is very deep and well drained. It formed in mixed glacial till, with an admixture of volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown stony loam about 6 inches thick. The lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray cobbly sandy loam to a depth of 60 inches or more.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed quartzite or shale. Most areas are very steep and convex.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. They are also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 42 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 42 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 49 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. The steep slopes restrict the use of equipment with wheels and tracks in skidding operations. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soil§. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The proper location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass Vlls, nonirrigated.

78-Dragoon silt loam, 8 to 25 percent shapes. This moderately deep, well drained soil is on toe slopes of foothills. It formed in residuum derived from granite, with an admixture of loess and volcanic ash in the surface layer. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is about 110 to 120 days.

Typically, the surface layer of this soil is dark grayish brown and grayish brown silt loam about 12 inches thick. The subsoil is pale brown and very pale brown clay loam about 18 inches thick. Below that is weathered granite at a depth of about 30 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 15 to 25 percent slopes-on lower toe slopes
- Dragoon silt loam, 8 to 25 percent slopes, Raisio shaly loam, 0 to 20 percent slopes, Spokane loam, 0 to 25 percent slopes, and Skanid loam, 0 to 25 percent slopes-on convex, south- and west-facing toe slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Dragoon soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used as grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 87 on the Dragoon soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 30 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 36 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes places naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings. The high soil surface temperatures in summer reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope fall chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by depth to bedrock. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass IVe, nonirrigated.

79-Dragoon silt loam, 25 to 45 percent slopes. This moderately deep, well drained soil is on foot slopes of foothills. It formed in residuum derived from granite, with an admixture of loess and volcanic ash in the surface layer. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is about 110 to 120 days.

Typically, the surface layer is dark grayish brown and grayish brown silt loam about 12 inches thick. The subsoil is pale brown and very pale brown clay loam about 18 inches thick. Below that is weathered granite at a depth of about 30 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes-on lower foot slopes
- Dragoon silt loam, 8 to 25 percent slopes, and Raisio shaly loam, 20 to 40 percent slopes-in places of contact with shale
- Spokane loam, 25 to 40 percent slopes, and Skanid loam, 25 to 40 percent slopes-on convex, south- and west-facing foot slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Dragoon soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 87 on the Dragoon soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of trees 6.6 inches in diameter at breast height (dbh) and larger is 30 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 36 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by depth to bedrock. The main limitations for septic tank absorption fields are the depth to rock and slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

80-Eloika silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in mixed glacial outwash material and ablation till and is mantled in volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown silt loam about 14 inches thick, and the lower part is light brown loam about 10 inches thick. The upper part of the substratum is pale brown gravelly loam about 20 inches thick, and the lower part is pale brown very gravelly sandy loam about 9 inches thick. Below that is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of

- Bonner silt loam, 0 to 10 percent slopes-on similar landscape positions
- Aits loam, 0 to 15 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on north- and east-facing upper toe slopes
- Clayton fine sandy loam, 0 to 5 percent slopes, and Laketon silt loam, 0 to 5 percent slopes-on terraces
- Wolfeson very fine sandy loam-in depressions The included areas make up about 20 percent of the total acreage.

The permeability of this Eloika soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 101 on the Eloika soil. The basal area is about 75 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 78 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when she soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, and spirea. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated barley, wheat, oats, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope fall chiseling help to control sheet and rill erosion. Retaining sufficient amounts of crop residue on the surface and incorporating minimum amounts into the surface layer help to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is moderately rapid to very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated.

81-Eloika very stony silt loam, 0 to 25 percent slopes. This very deep, well drained soil is on terraces. It formed in mixed glacial outwash material and ablation till and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown very stony silt loam about 14 inches thick, and the lower part is light brown loam about 10 inches thick. The upper part of the substratum is pale brown gravelly loam about 20 inches thick, and the lower part is pale brown very gravelly sandy loam about 9 inches thick. Below that is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on north- and east-facing foot slopes
- Bonner silt loam, 0 to 10 percent slopes, Clayton fine sandy loam, 5 to 15 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on lower terraces
- Wolfeson very fine sandy loam-in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Eloika soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 101 on the Eloika soil. The basal area is about 75 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 78 cubic feet per acre per year.

Stones on the surface of this soil can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, western larch, and lodgepole pine takes place naturally where seed trees are present If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, and spirea. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are moderately rapid to very rapid permeability in the substratum and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility. Absorption lines should be installed on the contour.

This soil is in capability subclass VIIs, nonirrigated.

82-Eloika very stony silt loam, 25 to 40 percent slopes. This deep, well drained soil is on terrace escarpments. It formed in mixed glacial outwash material and ablation till and is mantled with volcanic ash and loess. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown very stony silt loam about 14 inches thick, and the lower part is light brown loam about 10 inches thick. The upper part of the substratum is pale brown gravelly loam about 20 inches thick, and the lower part is pale brown very gravelly sandy loam about 9 inches thick. Below that is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on foot slopes
- Bonner silt loam, 0 to 10 percent slopes, Clayton fine sandy loam, 5 to 15 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on lower terraces
- Wolfeson very fine sandy loam-in depressions on terraces

The included areas make up about 25 percent of the total acreage.

The permeability of this Eloika soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 101 on the Eloika soil. The basal area is about 75 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inch dbh and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 78 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is stones on the surface. Stones can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, and spirea. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provided desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are moderately rapid to very rapid permeability in the substratum and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIIs, nonirrigated.

83-Garrison loam, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in glacial outwash material, with an admixture of loess or volcanic ash in the surface layer. The native vegetation is grasses, forbs, shrubs, and scattered conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 49° F. The frost-free season is 120 to 140 days.

Typically, the surface layer is dark grayish brown loam about 16 inches thick. The subsoil is brown gravelly loam about 8 inches thick. The substratum is brown very gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Phoebe sandy loam, 5 to 15 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes-on higher terraces
- Garrison gravelly loam, 0 to 5 percent slopes, and Peone silt loam-in depressions on bottom lands

The included areas make up about 15 percent of the total acreage.

The permeability of this Garrison soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for nonirrigated and irrigated crops. It has potential for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is available water capacity. Leaving sufficient amounts of crop residue on the surface and incorporating it into the surface layer and using minimum tillage help to maintain good tilth, conserve moisture, and control erosion. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil has potential for the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 101 on the Garrison soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 49 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels and tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack may hinder the use of equipment and limit access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The regeneration of cutover areas by ponderosa pine takes place naturally where seed trees are present. The high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, lupine, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is well suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIs, nonirrigated and irrigated.

84-Garrison loam, 5 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces and alluvial fans. It formed in glacial outwash material, with an admixture of loess or volcanic ash in the surface layer. Surfaces are planar. The native vegetation is grasses, forbs, shrubs, and scattered conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 49° F. The frost-free season is 120 to 140 days.

Typically, the surface layer is dark grayish brown loam about 16 inches thick. The subsoil is brown gravelly loam about 8 inches thick. The substratum is brown very gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Phoebe sandy loam, 5 to 15 percent slopes, Springdale sandy loam, 0 to 15 percent slopes, and Garrison loam, 0 to 5 percent slopes-on similar landscape positions
- Peone silt loam-on bottom lands
- Cedonia silt loam, 5 10 15 percent slopes-on higher terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Garrison soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is about 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated and irrigated crops. It has potential for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope, the hazard of water erosion, and available water capacity. Minimum tillage, early fall seeding, and cross slope fall tillage help to control erosion. Divided slope farming, stripcropping, diversions, or terraces also may be needed for erosion control. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil has potential for the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 101 on the Garrison soil, The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter, at breast height (dbh) and larger is 49 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack may hinder the use of equipment and limit access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The regeneration of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, lupine, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

85-Garrison gravelly loam, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in glacial outwash, with an admixture of loess and volcanic ash in the surface layer (fig. 7). The native vegetation is grasses, forbs, shrubs, and scattered conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 49° F. The frost-free season is 120 to 140 days.

Typically, the surface layer is dark grayish brown gravelly loam about 16 inches thick. The subsoil is brown gravelly loam about 8 inches thick. The substratum is brown very gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bong sandy loam, 0 to 15 percent slopes, Phoebe sandy loam, 0 to 5 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes-on higher terraces

The included areas make up about 20 percent of the total acreage.

The permeability of this Garrison soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

Figure 7.-A profile of Garrison gravelly loam. This soil formed in glacial outwash and has an admixture of loess and volcanic ash in the surface layer. It is somewhat excessively drained.

This soil is used for nonirrigated and irrigated crops. It has potential for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is available water capacity. Minimum tillage and retaining sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control erosion. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil has potential for the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 101 on the Garrison soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inch dbh and larger is 49 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack may hinder the use of equipment and limit access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The regeneration of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, lupine, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIs, nonirrigated and irrigated.

86-Green Bluff silt loam, 0 to 5 percent slopes. This very deep, well drained soil is on basalt plateaus and foothills. It formed in glacial till, with an admixture of loess and volcanic ash. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown silt loam about 6 inches thick, and the lower part is light brown and very pale brown silt loam about 42 inches thick. The substratum is yellowish brown loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Clayton fine sandy loam, 0 to 5 percent slopes, and Dearyton silt loam, 0 to 5 percent slopes-on similar landscape positions
- Bernhill silt loam, 0 to 15 percent slopes, and Bestrom silt loam, 0 to 15 percent slopes-on the slopes of foothills
- Hesseltine silt loam, 0 to 8 percent slopes-on outer edges of plateaus in terrace positions
- poorly drained soils in depressions and drainageways

The included areas make up about 20 percent of the total acreage.

The permeability of this Green Bluff soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, ponderosa pine, lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Green Bluff soil. The basal area is about 72 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 78 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by Douglas-fir, western larch, ponderosa pine, and lodgepole pine takes place naturally where seed trees are present If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly pinegrass, elk sedge, common snowberry, and strawberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is the hazard of water erosion. Minimum tillage and early fall seeding help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3year rotation of winter wheat, spring grain, and summer fallow for weed control.

This soil is well suited to homesite development.

This soil is in capability subclass IIc, nonirrigated.

87-Green Bluff silt loam, 5 to 15 percent slopes. This very deep, well drained soil is on undulating basalt plateaus. It formed in glacial till, with an admixture of loess and volcanic ash. Slopes are complex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from about 110 to 130 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is brown silt loam about 6 inches thick, and the lower part is light brown and very pale brown silt loam about 42 inches thick. The substratum is yellowish brown loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Clayton fine sandy loam, 0 to 5 percent slopes, and Dearyton silt loam, 0 to 5 percent slopes-on similar landscape positions
- Bernhill silt loam, 15 to 25 percent slopes, and Bestrom silt loam, 15 to 25 percent slopes-on the slopes of foothills
- Hesseltine silt loam, 0 to 8 percent slopes-on outer edges of plateaus on terraces
- poorly drained soils in drainageways

The included areas make up about 25 percent of the total acreage.

The permeability of this Green Bluff soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, ponderosa pine and lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Green Bluff soil. The basal area is about 72 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 78 cubic feet per acre per year.

Using standard equipment with wheels and tracks causes rutting and compaction when this soil is moist.

Using low pressure ground equipment reduces soil damage and helps to maintain productivity. fuddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, ponderosa pine, or lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly pinegrass, elk sedge, blue wildrye, common snowberry, and other forbs and shrubs. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass, is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 to 3 years.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

88-Hagen sandy loam, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in mixed, sandy glacial outwash material. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 19 inches, and the average air temperature is about 48° F. The frost-free season is 110 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown sandy loam about 5 inches thick. The upper part of the underlying material is pale brown and very pale brown sandy loam about 17 inches thick, and the lower part is very pale brown loamy fine sand about 10 inches thick. Below that is light gray fine and medium sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Koerling fine sandy loam, 0 to 5 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Bisbee loamy fine sand, 0 to 15 percent slopes, and Marble loamy sand, 5 to 25 percent slopes on dunelike terraces
- Wethey loamy sand and Wolfeson very fine sandy loam-in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Hagen soil is moderately rapid in the upper part and very rapid in the lower part. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight to moderate, and the hazard of wind erosion is high.

This soil is mainly used for grazeable woodland. Some small areas are used for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 98 on the Hagen soil. The basal area is about 81 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 80 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and surface displacement when this soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, lodgepole pine, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and low available water capacity reduce the chances of seedling survival. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly

pinegrass, elk sedge, prairie junegrass, kinnikinnick, and strawberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated barley, wheat, alfalfa, and grass Is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay. The main limitations are the hazard of wind erosion and available water capacity. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

89-Hagen sandy loam, 15 to 40 percent slopes. This very deep, somewhat excessively drained soil is on terraces and terrace escarpments. It formed in mixed, sandy glacial outwash material. Surfaces are planar. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 19 inches, and the average air temperature is about 48° F. The frost-free season is 110 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic lifter about 1 inch thick. The surface layer is pale brown sandy loam about 5 inches thick. The upper part of the underlying material is pale brown and very pale brown sandy loam about 17 inches thick, and the lower part is very pale brown loamy fine sand about 10 inches thick. Below that is light gray fine and medium sand that has a thick, dark brown loamy band. It extends to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Koerling fine sandy loam, 0 to 5 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Bisbee loamy fine sand, 25 to 40 percent slopes, and Marble loamy sand, 5 to 25 percent slopes on dunelike terraces
- Wethey loamy sand and Wolfeson very fine sandy loam-in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Hagen soil is moderately rapid in the upper part and very rapid in the lower part. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is high.

This soil is used as grazeable woodland. However, some small areas on slopes of less than about 30 percent are used for nonirrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 98 on the Hagen soil. The basal area is about 81 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 80 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and surface displacement when this soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the soils that have slopes of about 25 to 40 percent.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, lodgepole pine, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Trees occasionally are subject to windthrow during periods when the soil is excessively wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, elk sedge, prairie junegrass, kinnikinnick, and strawberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated barley, wheat, alfalfa, and grass is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is in capability subclass IVe, nonirrigated.

90-Hardesty silt loam. This very deep, moderately well drained soil is in bottom lands and basins and on alluvial fans. It formed in alluvium that is more than 60 percent volcanic ash. Slope is 0 to 5 percent. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 105 to 125 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown and brown silt loam about 15 inches thick. The underlying material is pale brown very fine sandy loam and fine sandy loam to a depth of 60 inches or more. There is a similar soil that has a very fine sandy loam surface layer.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes on terraces
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terrace
- Narcisse silt loam and Peone silt loam-on bottom lands along drainageways and streams

The included areas make up about 15 percent of the total acreage.

The permeability of this Hardesty soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very slow. There is no hazard of water erosion, or it is slight. This soil is subject to flooding.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 89 on the Hardesty soil. The basal area is about 51 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 36 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 42 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, lodgepole pine, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, Oregon-grape, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is the limited frost-free season. Minimum tillage and early seeding will help to control erosion. Leaving crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay. The main limitation is the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is the hazard of flooding. Buildings should be located above the expected flood level. Dikes and channels can be used to protect homesites from being flooded. Cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is the hazard of flooding.

This soil is in capability subclass IIw, nonirrigated and irrigated.

91-Hartill silt loam, 0 to 15 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is very pale brown shaly loam about 13 inches thick, and the lower part is pale yellow very shaly loam about 12 inches thick. Fractured phyllite is at a depth of about 37 inches. Depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are areas of-

- similar soils on outwash terraces-on the lower parts of toe slopes
- Aits loam, 0 to 15 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on lower toe slopes
- Buhrig very stony loam, 25 to 40 percent slopes on upper foot slopes and ridges
- Huckleberry silt loam, 25 to 40 percent slopes on upper foot slopes
- Moscow silt loam, 25 to 40 percent slopes-in places of granitic contact
- Raisio shaly loam, 20 to 40 percent slopes-on convex, south- and west-facing foot slopes
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Hartill soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Hartill soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, spirea, and strawberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is erosion. Minimum tillage, early fall seeding, and leaving crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

This soil is suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

92-Hartill silt loam, 15 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is very pale brown shaly loam about 13 inches thick, and the lower part is pale yellow very shaly loam about 12 inches thick. Fractured phyllite is at a depth of about 37 inches. Depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are areas of-

- a similar soil on outwash terrace and lakebed remnants-on the lower parts of toe slopes
- Aits loam, 15 to 25 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on lower toe slopes
- Buhrig very stony loam, 25 to 40 percent slopes-on upper slopes and ridges
- Huckleberry silt loam, 25 to 40 percent slopes-on foot slopes
- Moscow silt loam, 0 to 25 percent slopes-in places of granitic contact
- Raisio shaly loam, 20 to 40 percent slopes-on south- and west-facing slopes
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Hartill soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Hartill soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings. This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, spirea, and strawberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and cross slope fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass IVe, nonirrigated.

93-Hartill silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes and side slopes of mountains. It formed in colluvium and residuum derived from shale and is mantled with volcanic ash. The aspect is to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is very pale brown shaly loam about 13 inches thick, and the lower part is pale yellow very shaly loam about 12 inches thick. Fractured phyllite is at a depth of about 37 inches. Depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are areas of-

- similar soils on outwash and lakebed terraces-on the lower parts of foot slopes
- Aits loam, 25 to 40 percent slopes, arid Newbell silt loam, 25 to 40 percent slopes-on lower foot slopes
- Buhrig very stony loam, 25 to 40 percent slopes on upper foot slopes and ridges
- Huckleberry silt loam, 25 to 40 percent slopes on upper foot slopes
- Moscow silt loam, 25 to 40 percent slopes-in places of granitic contact
- Raisio shaly loam, 25 to 40 percent slopes-on south- and west-facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Hartill soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Hartill soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast: height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, spirea, and strawberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

94-Hartill silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash. The aspect is to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is very pale brown shaly loam about 13 inches thick, and the lower part is pale yellow very shaly loam about 12 inches thick. Fractured phyllite is at a depth of about 37 inches. Depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on the lower parts of side slopes
- Buhrig very stony loam, 40 to 65 percent slopes on upper side slopes and ridges
- Huckleberry silt loam, 40 to 65 percent slopes on upper side slopes
- Moscow silt loam, 40 to 65 percent slopes-in places of granitic contact
- Raisio shaly loam, 40 to 65 percent slopes-on south- and west-facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 25 percent of the total acreage.

The permeability of this Hartill soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Hartill soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. The use of standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, lodgepole pine, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or western white pine seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, creambush oceanspray, spirea, and strawberry.

This soil is in capability subclass VIIe, nonirrigated.

95-Hesseltine silt loam, 0 to 8 percent slopes. This very deep, well drained soil is on foothills and terraces. It formed in glacial outwash material, with an admixture of loess and volcanic ash in the upper part. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown silt loam about 10 inches thick. The upper part of the subsoil is pale brown gravelly silt loam about 8 inches thick, and the lower part is light yellowish brown very gravelly loam about 10 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of 60 inches or more

Included with this soil in mapping are areas of-

- Cheney silt loam, 0 to 15 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Garrison loam, 0 to 5 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes on similar landscape positions
- Bestrom silt loam, 0 to 15 percent slopes-on convex slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Hardesty silt loam-on alluvial fans, in intermittent drainageways, and in slight depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Hesseltine soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 99 on the Hesseltine soil. The basal area is about 40 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment helps to reduce soil damage and maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling across the slope, and leaving crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Grassed waterways help to control erosion from concentrated flow in the major drains and waterways. A suitable crop rotation on this soil is alfalfa aid grass for 4 to 8 years followed by grain for 2 to 3 years.

This soil is suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated.

96-Hesseltine stony silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on undulating terraces on foothills. It formed in glacial outwash material, with an admixture of loess and volcanic ash in the upper part. Slopes are complex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown stony silt loam about 10 inches thick. The upper part of the subsoil is pale brown gravelly silt loam about 8 inches thick, and the lower part is light yellowish brown very gravelly loam about 10 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of more than 60 inches.

Included with this soil in mapping are areas of-

- Cheney stony silt loam, 5 to 25 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Garrison gravelly loam, 0 to 5 percent slopes, and Springdale cobbly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Bestrom silt loam, 0 to 15 percent slopes-on convex slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Hardesty silt loam-on alluvial fans

The included areas make up about 20 percent of the area.

The permeability of this Hesseltine soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 99 on the Hesseltine soil. The basal area is about 40 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIe, nonirrigated.

97-Hesseltine-Rock outcrop complex, 0 to 25 percent slopes. The soils in this complex are on terraces and foothills. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 110 days. This unit is about 65 percent Hesseltine stony silt loam, 0 to 25 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Cheney stony silt loam, 5 to 25 percent slopes, Dart loamy coarse sand, 0 to 8 percent slopes, Garrison gravelly loam, 0 to 5 percent slopes, and Springdale cobbly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Bestrom silt loam, 0 to 15 percent slopes-on convex slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Hardesty silt loam-on alluvial fans

The included areas make up about 15 percent of the area.

The Hesseltine soil is deep and well drained. It formed in glacial outwash material, with an admixture of loess and volcanic ash in the upper part. Slopes are complex. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown stony silt loam about 10 inches thick. The upper part of the subsoil is pale brown gravelly silt loam about 8 inches thick, and the lower part is light yellowish brown very gravelly loam about 10 inches thick. The substratum is multicolored extremely gravelly coarse sand to a depth of 60 inches or more.

The permeability of this Hesseltine soil is moderate to the substratum and very rapid through it. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed basalt on knobs, ridges, and plateau escarpments. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 99 on the Hesseltine soil. The basal area is about 32 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 28 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 32 cubic feet per acre per year.

Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Rock outcrop limits the even distribution of reforestation.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded it overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are Rock outcrop and steepness of slope. Excavations for building sites are limited by Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are very rapid permeability in the substratum, Rock outcrop, and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility. Absorption lines should be installed on the contour. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

98-Histosols, ponded. Histosols are deep, very poorly drained soils in depressional areas around perimeters of lakes and beaver ponds. They formed in organic material, with an admixture of alluvium, mostly volcanic ash. Slope is 0 to 2 percent. The vegetation is mainly rushes, sedges, cattails, and reeds. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface tier is dark reddish brown sapric material about 18 inches thick. The upper tier of the underlying material is dark reddish brown hemic material about 12 inches thick. The lower tier is olive brown hemic material to a depth of 60 inches or more.

These soils have little or no farm use. Shallow water covers most areas at least 9 months of the year. However, during the summer months when the water table is below the surface, livestock can be pastured on some areas.

These soils are well suited to habitat for water-loving birds and animals.

These soils are in capability subclass Vllw, nonirrigated.

99-Hodgson silt loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is light gray silt loam about 3 inches thick. The subsoil is very pale brown silty clay and light gray silty clay loam about 18 inches thick. The substratum is light gray and white silty clay to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Koerling fine sandy loam, 0 to 5 percent slopes, and Laketon silt loam, 0 to 5 percent slopes-on similar landscape positions
- Bridgeson silt loam, Chewelah fine sandy loam, and Colville silt loam-on bottom lands
- Hodgson silt loam, 3 to 15 percent slopes-in undulating areas
- Hodgson silt loam, 25 to 40 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Hodgson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow. There is no hazard of water erosion, or it is slight. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for nonirrigated and irrigated crops and for grazeable woodland.

This soil is well suited to the production of nonirrigated wheat, barley, alfalfa, and grasses. The main limitation is a seasonal high water table. Incorporating crop residue into the surface layer helps to maintain good tilth. The proper timing of minimum tillage helps to avoid compaction. Tile drainage, open ditches, or tile drainage and open ditches in combination can be used to remove excess surface and subsurface water if suitable outlets are available. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Hodgson soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 62 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Fuddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted gasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitation is the shrink-swell potential. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for this restriction.

This soil is in capability subclass Ilw, nonirrigated and irrigated.

100-Hodgson silt loam, 3 to 15 percent slopes. This very deep, moderately well drained soil is on undulating terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is light gray silt loam about 3 inches thick. The subsoil is very pale brown silty clay and light gray silty clay loam 18 inches or more in thickness. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Koerling fine sandy loam, 5 to 15 percent slopes, Hodgson silt loam, 0 to 3 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on similar landscape positions
- Bridgeson silt loam, Chewelah fine sandy loam, and Colville silt loam-in drainageways and on lower terraces
- Hodgson silt loam, 25 to 40 percent slopes-on terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Hodgson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for nonirrigated and irrigated crops and for grazeable woodland.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass-legume hay. The main limitation is slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Hodgson soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 62 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally slump when the soil is saturated.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes places naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitations are the shrink-swell potential and steepness of slope. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from the building help to prevent the structural damage caused by shrinking and swelling. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

101-Hodgson silt loam, 15 to 25 percent slopes. This very deep, moderately well drained soil is on rolling 'terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess (fig. 8). The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is light gray silt loam about 3 inches thick. The subsoil is very pale brown silty clay and light gray silty clay loam about 18 inches thick. The substratum is light gray and white silty clay to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

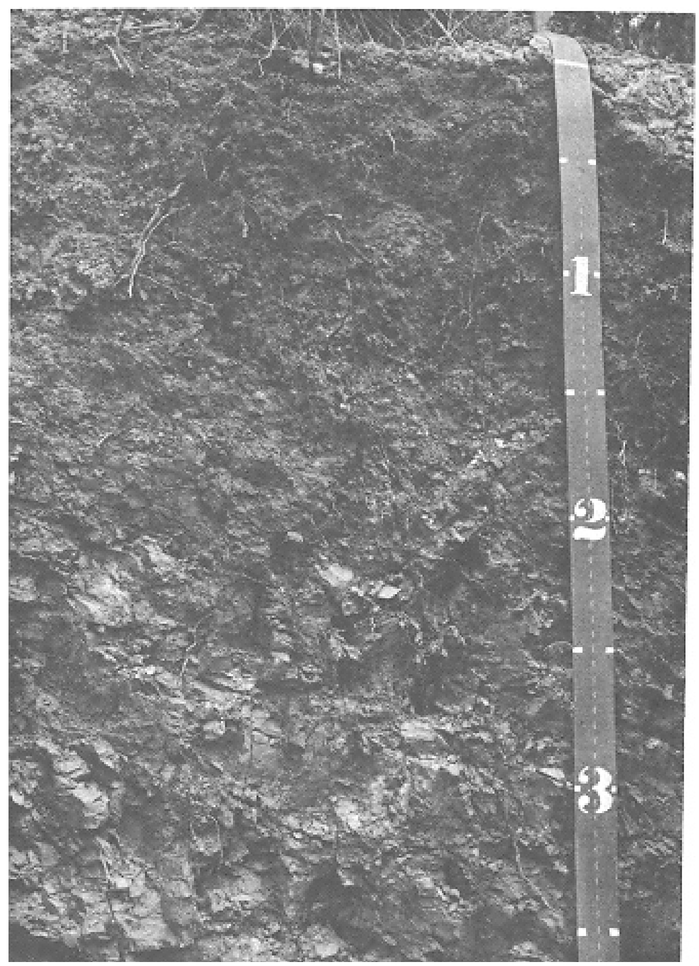

Figure 8.-A profile of Hodgson silt loam, 15 to 25 percent slopes. This soil formed in glacial lake sediment and is mantled with volcanic ash and loess. The bedding is lacustrine sediment.

- Koerling fine sandy loam, 5 to 15 percent slopes, Hodgson silt loam, 3 to 15 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on similar landscape positions
- Bridgeson silt loam-in drainageways and on lower terraces
- Hodgson silt loam, 25 to 40 percent slopes-on terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Hodgson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for nonirrigated and irrigated crops and for grazeable woodland.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to hell) control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass-legume hay. The main limitation is slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Hodgson soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 62 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally slump when the soil is wet.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability.

This soil is in capability subclass IVe, nonirrigated and irrigated.

102-Hodgson silt loam, 25 to 40 percent slopes. This very deep, moderately well drained soil is on terrace escarpments. It formed in glacial lake sediment and is mantled with volcanic ash and loess. Surfaces are planar. The native vegetation is trees, shrubs, forbs, and grasses. Elevation is 1,600 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is light gray silt loam about 3 inches thick. The subsoil is very pale brown silty clay and light gray silty clay loam about 18 inches thick. The substratum is light gray and white silty clay to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Koerling silt loam, 30 to 65 percent slopes-on similar landscape positions
- Bridgeson silt loam-in drainageways
- Hodgson silt loam, 3 to 15 percent slopes-on terraces

The included areas make up about 20 percent of the total acreage.

The permeability of this Hodgson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for grazeable woodland.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Hodgson soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 62 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when this soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur if the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Cutbanks occasionally cave when they are saturated.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

103-Huckleberry silt loam, 0 to 15 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and in all directions at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and a small amount of grass. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 37 inches, and the average air temperature is about 43° F. The frost-free season is 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is pale brown silt loam about 6 inches thick after mixing. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown shaly silt loam about 7 inches thick. The lower part is pale brown and light brownish gray very shaly loam about 11 inches thick. Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Belzar silt loam, 5 to 25 percent slopes-on convex slopes
- Hartill silt loam, 0 to 15 percent slopes-on convex, south- and west-facing slopes
- Huckleberry silt loam, 15 to 25 percent slopes
- Manley silt loam, 0 to 20 percent slopes-on concave slopes
- Vassar silt loam-on convex slopes in places of granitic contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on this Huckleberry soil. The basal area is about 88 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

This soil is suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Absorption lines should be installed on the contour.

This soil is in capability subclass VIe, nonirrigated.

104-Huckleberry silt loam, 15 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains (fig. 9). It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and in all directions at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and a small amount of grass. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 37 inches, and the average annual air temperature is about 43° F. The frost-free season is 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2

Figure 9.-Huckleberry silt loam is on the mountain slopes at the left, Aits loam is at mid slope in the center, and Hunters silt loam is on the valley bottom in the foreground. The Huckleberry soils are in the cryic temperature zone, the Aits soils are in the frigid zone, and the Hunters soils are in the mesic zone.

inches thick. The surface layer is pale brown silt loam about 6 inches thick after mixing. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown shaly silt loam about 7 inches thick. The lower part is pale brown aid light brownish gray very shaly loam about 11 inches thick, Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Belzar silt loam, 5 to 25 percent slopes, Brickel stony loam, 20 to 60 percent slopes, and Buhrig very stony loam, 25 to 40 percent slopes-on ridgetops and upper side slopes
- Hartill silt loam, 15 to 25 percent slopes-on convex slopes with south- and west-facing slopes
- Huckleberry silt loam, 25 to 40 percent slopes
- Manley silt loam, 20 to 40 percent slopes-on concave slopes
- Vassar silt loam-on convex, moderately steep slopes in places of granitic contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop and talus downslope from Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Huckleberry soil. The basal area is about 88 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

105-Huckleberry silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and in all directions at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and a small amount of grass. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 37 inches, and the average annual air temperature is about 43° F. The frost-free season is 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is pale brown silt loam about 6 inches thick after mixing. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown shaly silt loam about 7 inches thick, and the lower part is pale brown and light brownish gray very shaly loam about 11 inches thick. Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Belzar silt loam, 25 to 40 percent slopes-on convex slopes
- Brickel stony loam, 20 to 60 percent slopes, and Buhrig very stony loam, 25 to 40 percent slopes-on ridgetops and upper side slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- Huckleberry silt loam, 40 to 65 percent slopes
- Manley silt loam, 20 to 40 percent slopes-on concave slopes
- Vassar silt loam, 30 to 65 percent slopes-on convex slopes in places of granitic contact

- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs and talus downslope from Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Huckleberry soil. The basal area is about 88 percent of normal, even-aged unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gulls erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brash species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass Vle, nonirrigated.

106-Huckleberry silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and in all directions at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and a small amount of grass. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 32 inches, and the average annual air temperature is about 43° F. The frost-free season is 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is pale brown silt loam about 6 inches thick after mixing. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown shaly silt loam about 7 inches thick, and the lower part is pale brown and light brownish gray very shaly loam about 11 inches thick. Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches. In places is a similar soil that has bedrock at a depth of less than 20 inches.

Included with this soil in mapping are areas of-

- Belzar silt loam, 40 to 65 percent slopes-on convex slopes
- Brickel stony loam, 20 to 60 percent slopes, and Buhrig very stony loam, 40 to 65 percent slopes-on ridgetops and upper side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Manley silt loam, 40 to 65 percent slopes-on concave slopes
- Vassar silt loam, 30 to 65 percent slopes-on convex slopes in places of granitic contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs and talus downslope from Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Huckleberry soil. The basal area is about 88 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI of trees 0.6 inch dbh and larger is 72 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and dully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut aid fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading crush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

This soil is in capability subclass VIIe, nonirrigated.

107-Huckleberry-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the north and east at lower elevations and in all directions at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 32 inches, and the average annual air temperature is about 43° F. The frost-free season is 70 to 90 days. This complex is about 65 percent Huckleberry silt loam, 30 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Belzar silt loam, 40 to 65 percent slopes-on convex slopes in places of limestone contact
- Brickel stony loam, 20 to 60 percent slopes, and Buhrig very stony loam, 40 to 65 percent slopes-on ridgetops and upper side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Manley silt loam, 40 to 65 percent slopes-on concave slopes
- Vassar silt loam, 30 to 65 percent slopes-on convex slopes in places of granitic contact
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs and talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Huckleberry soil is moderately deep and well drained. It formed in colluvium and residuum weathered from shaly rock and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is pale brown silt loam about 6 inches thick after mixing. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown shaly silt loam about 7 inches thick, and the lower part is pale brown and light brownish gray very shaly loam about 11 inches thick. Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed shale on ridges and knobs. Most areas are steep or very steep.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch, lodgepole pine, grand fir, and western white pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Huckleberry soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 52 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Puddling can occur when the soils are wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and western white pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of these soils, the understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

The soils in this complex are in capability subclass VIIs, nonirrigated.

108-Hunters silt loam, 0 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in calcareous, mixed glacial lake sediment, with an admixture of loess and volcanic ash. The native vegetation is shrubs, forbs, and grasses. Elevation is 1,500 to 2,300 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 125 days.

Typically, the surface layer is grayish brown silt loam about 18 inches thick. The subsoil is pale brown silt loam about 12 inches thick. The substratum is light gray silt loam and very fine sandy loam to a depth of 60 inches or more. The soil is calcareous in the subsoil and substratum.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 0 to 5 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Koerling fine sandy loam, 0 to 5 percent slopes-on similar landscape positions
- Colville silt loam-on bottom lands
- Donavan loam, 0 to 8 percent slopes, and Stevens silt loam, 0 to 8 percent slopes-on convex, south- and west-facing toe slopes
- Peone silt loam-on alluvial fans and bottom lands and in depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Hunters soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for nonirrigated and irrigated crops and has potential for grazeable woodland.

This soil is well suited to the production of irrigated and nonirrigated wheat, barley, alfalfa, and grasses. The main limitation is the hazard of water erosion Minimum tillage, early fall seeding, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter grain, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay. The main limitation is the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil has potential for the production of ponderosa pine. Douglas-fir also can grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is estimated to be 110 on the Hunters soil. The basal area will develop to about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 63 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 73 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush and grass species that are not controlled will delay the establishment of natural reforestation. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly bluebunch wheatgrass and Idaho fescue. Thinning, logging, or fire reduces the density of the canopy cover and allows for increased growth of the understory vegetation. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitation is the shrink-swell potential. Proper design of foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIe, irrigated, and IIc, nonirrigated.

109-Hunters silt loam, 5 to 15 percent slopes. This very deep, well drained soil is on undulating terraces. It formed in calcareous, mixed glacial lake sediment, with an admixture of loess and volcanic ash. The native vegetation is shrubs, forbs, and grasses. Elevation is

1,500 to 2,300 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 125 days.

Typically, the surface layer is grayish brown silt loam about 18 inches thick. The subsoil is pale brown silt loam about 12 inches thick. The substratum is light gray silt loam and very fine sandy loam to a depth of 60 inches or more. The soil is calcareous in the subsoil and substratum.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 5 to 15 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Koerling fine sandy loam, 5 to 15 percent slopes-on similar landscape positions
- Colville silt loam-on bottom lands
- Donavan loam, 8 to 25 percent slopes, and Stevens silt loam, 8 to 15 percent slopes-on convex, south- and west-facing toe slopes
- Peone silt loam-on alluvial fans and bottom lands and in depressions
- Hardesty silt loam-on bottom lands and alluvial fans and in basins

The included areas make up about 15 percent of the total acreage.

The permeability of this Hunters soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for nonirrigated and irrigated crops and has potential for grazeable woodland.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early fall seeding, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, grassed waterways, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and legume hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil has potential for the production of ponderosa pine. Douglas-fir also can grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is estimated to be 110 on the Hunters soil. The basal area will develop to about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 63 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 73 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush and grass species that are not controlled will delay the establishment of natural reforestation. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. The native understory vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to homesite development. The main limitations are the shrink-swell potential and steepness of slope. Proper design of foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Special design is needed for buildings, roads, and streets to overcome the limitation of slope. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

110-Inkler silt loam, 0 to 20 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till, residuum, and colluvium, with an admixture of volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface is gray silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow very cobbly sandy clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Merkel stony sandy loam, 0 to 40 percent slopes-on similar landscape positions
- Aits loam, 0 to 15 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on concave slopes
- Inkler gravelly silt loam, 20 to 40 percent slopes-on upper toe slopes
- similar soils on outwash and lakebed terraces and on lower toe slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. A few areas have been cleared and are used for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The basal area is about 61 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 57 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 66 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, spirea, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

111-Inkler gravelly silt loam, 20 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till, residuum, and colluvium, with an admixture of volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface layer is gray gravelly silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow very cobbly sandy clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Merkel stony sandy loam, 0 to 40 percent slopes-on similar landscape positions
- Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on concave slopes
- Inkler silt loam, 0 to 20 percent slopes-on lower foot slopes
- Hartill silt loam, 25 to 40 percent slopes-on upper foot slopes
- Kiehl gravelly silt loam, 0 to 20 percent slopes on outwash terrace remnants and along drainageways
- a similar soil on lakes and terraces and on lower parts of foot slopes
- Rock outcrop on knobs and ridges

The included areas make up about 15 percent of the total acreage.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The basal area is about 61 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 57 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 66 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control Erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled can delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, spirea, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass Vle, nonirrigated.

112-Inkler gravelly silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till, residuum, and colluvium, with an admixture of volcanic ash in the surface layer. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface layer is gray gravelly silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow very cobbly sandy clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Merkel stony sandy loam, 40 to 65 percent slopes-on a similar landscape position
- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on concave slopes
- Inkler gravelly silt loam, 20 to 40 percent slopes on lower side slopes
- Hartill silt loam, 40 to 65 percent slopes-on upper side slopes
- Kiehl gravelly silt loam, 20 to 65 percent slopes on remnant outwash terrace escarpments, breaks, and side slopes of drainageways
- a soil on lakebed terraces on the lower part of side slopes
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The basal area is about 61 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 57 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 66 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, spirea, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

113-Inkler-Rock outcrop complex, 20 1o 40 percent slopes. The soils in this complex are on foot slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Inkler gravelly silt loam, 20 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Merkel stony sandy loam, 0 to 40 percent slopes-on similar landscape positions
- Aits loam, 25 to 40 percent slopes, arid Newbell silt loam, 25 to 40 percent slopes-on concave slopes
- Hartill silt loam, 25 to 40 percent slop as-on the upper parts of foot slopes
- Kiehl gravelly silt loam, 0 to 20 percent slopes on outwash terraces and along drainageways
- very stony and very shallow soils
- a soil on lakebed terraces on the lower parts of foot slopes

The included areas make up about 15 percent of the total acreage.

The Inkler soil is very deep and well drained. It formed in glacial till, residuum, and colluvium, with an admixture of volcanic ash in the surface layer. Typically, the surface is gray gravelly silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow very cobbly sandy clay loam to a depth of 60 inches or more.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed andesite, quartzite, or shale. Most areas are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The basal area is about 27 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 29 cubic feet per acre per year.

Rock outcrop can cause breakage of timber and hinder yarding operations on these soils. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes places naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled can delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, spirea, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitations imposed by slopes. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are steepness of slope and Rock outcrop. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

114-Inkler-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Inkler gravelly silt loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Merkel stony sandy loam, 40 to 65 percent slopes-in similar landscape positions
- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on concave slopes
- Hartill silt loam, 40 to 65 percent slopes-on the upper parts of side slopes;
- Kiehl gravelly silt loam, 20 to 65 percent: slopes on remnant outwash terrace escarpments and side slopes of drainageways
- very stony and very shallow soils
- a soil on lakebed terraces on the lower parts of side slopes
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Inkler soil is very deep and well drained.. It formed in glacial till, residuum, and colluvium, with an admixture of volcanic ash in the surface layer. Typically, the surface is gray gravelly silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow very cobbly sandy clay loam to a depth of 60 inches; or more.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed andesite, quartzite, or shale. Most areas are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The banal area is about 27 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 29 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, common snowberry, spirea, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope can limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass Vlls, nonirrigated.

115-Kegel loam. This very deep, somewhat poorly drained soil is on low alluvial terraces and perimeters of lakes and ponds. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, shrubs, and conifers. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed material about 1 inch thick. The surface layer is dark gray and grayish brown loam about 14 inches thick. The underlying material is brown very gravelly loamy sand about 5 inches thick. Below that is a buried, grayish brown sandy loam surface layer about 19 inches thick. This layer is underlain by mottled, light olive brown very gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Chamokane loam and Narcisse silt loam-on higher terraces

- Peone silt loam-in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Kegel soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by the seasonal high water table that is at a depth of 1 foot to 2 feet during the months of January to May. This soil is subject to occasional, brief periods of flooding during the months of March to June. Channeling and deposition are common along streambanks. Runoff is slow. There is no hazard of erosion.

This soil is used for grazeable woodland. A few areas are used for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to grand fir, western larch, and Engelmann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 92 on the Kegel soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 84 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 62 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. A seasonal high water table restricts the use of equipment to midsummer or midwinter months when the soil is dry or frozen.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads may need ballast for year-round use.

The reforestation of cutover areas by Douglas-fir and Englemann spruce takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Survival of seedlings may be poor in areas where flooding occurs. The seasonal high water table restricts root development. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of grand fir, Engelmann spruce, or western redcedar seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly sedge, Kentucky bluegrass, common snowberry, and strawberry. Overgrazing causes desirable plants, such as sedge and Kentucky bluegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation for the production of nonirrigated wheat, oats, clover, and grasses is wetness and the hazard of flooding. Spring planting may be delayed because of flooding and wetness. The proper timing of minimum tillage helps to avoid compaction. Incorporating crop residue into the surface layer helps to maintain good tilth. Protective levees and artificial drainage help to control flooding and lower the water table. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from flooding. Drainage is needed if buildings are constructed on this soil. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are flooding, wetness, and rapid permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IVw, nonirrigated.

116-Kiehl gravelly silt loam, 0 to 20 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash material, with an admixture of volcanic ash and loess in the upper part. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 27 inches, and the average annual temperature is about 42° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The upper part of the subsoil is pink gravelly silt loam about 11 inches thick, and the lower part is very pale brown gravelly fine sandy loam about 11 inches thick. The substratum is very pale brown extremely gravelly loamy sand and extremely gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, and Eloika silt loam, 0 to 15 percent slopes-in similar landscape positions
- Aits loam, 0 to 15 percent slopes, and Newbell silt loam, 0 to 25 percent slopes-on the slopes of foothills
- Kiehl gravelly silt loam, 20 to 65 percent slopes on terrace escarpments
- Rathdrum silt loam-in depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Kiehl soil is moderately rapid through the subsoil and rapid below. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland. A few areas are cleared and are used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. Ponderosa pine and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Kiehl soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 51 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and northern twinflower. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can bee seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the steepness of slope. Minimum tillage, early fall seeding, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitations are large stones and steep less of slope. Stones can hinder excavations. Special design of buildings is needed to overcome the limitation imposed by slope. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic: tank absorption fields are rapid permeability in the substratum and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

117-Kiehl gravelly silt loam, 20 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in glacial outwash material, with an admixture of volcanic ash and loess in the upper part. Surfaces are planar. The native vegetation is conifers, grasses, shrubs, and forbs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 27 inches, and the average annual temperature is about 42° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The upper part of the subsoil is pink gravelly silt loam about 11 inches thick, and the lower part is very pale brown gravelly fine sandy loam about 11 inches thick. The substratum is very pale brown extremely gravelly loamy sand and extremely gravelly loamy coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on similar landscape positions
- Kiehl gravelly silt loam, 0 to 20 percent slopes on the upper edges of terrace escarpments
- Rathdrum silt loam-at the base of outwash terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Kiehl soil is moderately rapid through the subsoil and rapid below. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used as grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine and lodgepole pine also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Kiehl soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 51 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on

this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and northern twinflower. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are rapid permeability in the substratum and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIIe, nonirrigated.

118-Koerling fine sandy loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glaciofluvial material, with an admixture of volcanic ash and loess, and is underlain by stratified, calcareous glacial lake sediment. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 2,000 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 46° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is grayish broom fine sandy loam about 9 inches thick. The subsoil is pale brown and light brownish gray fine sandy loam about 31 inches thick. The substratum is light gray silty clay loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 0 to 5 percent slopes, and Hodgson silt loam, 0 to 3 percent slopes-on similar landscape positions
- Bisbee loamy fine sand, 0 to 15 percent slopes-on dunelike terraces
- Hagen sandy loam, 0 to 15 percent slopes-along drainageways and on outwash terraces
- Koerling fine sandy loam, 5 to 15 percent slopes-on drainage side slopes
- poorly drained soils in depressions

The included areas make up about 15 percent of the total acreage.

The permeability of this Koerling soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight to moderate, and the hazard of wind erosion is high. A perched water table is at a depth of 24 to 40 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir and, occasionally, western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 93 on the Koerling soil. The basal area is about 33 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 30 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, prairie junegrass, common snowberry, and common yarrow. Overgrazing causes desirable plants, such as pinegrass and prairie junegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is suited to the production of nonirrigated wheat, barley, oats, alfalfa, and grass, but it is limited by wetness and the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland.

Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control. Proper timing of minimum tillage helps to avoid compaction. Tile drains, open ditches, or tile drainage and open ditches in combination can be used to remove excess surface and subsurface water if suitable outlets are available.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, alfalfa, and grass for hay. The main limitations are the hazards of wind and water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to homesite development. The main limitation for septic tank absorption fields is moderate permeability. Using sandy backfill for the trench and extending the absorption lines help to overcome this limitation.

This soil is in capability subclass IIw, nonirrigated and irrigated.

119-Koerling fine sandy loam, 5 to 15 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glaciofluvial material, with an admixture of volcanic ash and loess, and is underlain by stratified, calcareous glacial lake sediment. The native vegetation is trees, shrubs, forbs, and grasses. Elevation is 1,500 to 2,000 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 46° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is grayish brown fine sandy loam about 9 inches thick. The subsoil is pale brown and light brownish gray fine sandy loam about 31 inches thick. The substratum is light gray silty clay loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 0 to 5 percent slopes, and Hodgson silt loam, 3 to 15 percent slopes-on similar landscape positions
- Bisbee loamy fine sand, 0 to 15 percent slopes-on dunelike terraces
- Hagen sandy loam, 0 to 15 percent slopes-along drainageways and on outwash terraces
- Koerling fine sandy loam, 30 to 65 percent slopes-on terrace escarpments and drainage side slopes
- poorly drained soils in drainageways and soils adjacent to springs and seeps

The included areas make up about 15 percent of the total acreage.

The permeability of this Koerling soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 24 to 40 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir and, occasionally, western larch are also suited to this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 93 on the Koerling soil. The basal area is about 33 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 30 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native vegetation is mainly pinegrass, prairie junegrass, common snowberry, and common yarrow. Overgrazing causes desirable plants, such as pinegrass and prairie junegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grasses are the hazards of wind and water erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes in rotation also provide excellent wind erosion control. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa-grass for 4 to 8 years followed by grain for 2 to 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. The main limitations are steepness of slope and the hazards of wind and water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome the limitations imposed by slope and permeability. The main limitations for septic tank absorption fields are steepness of slope and moderate permeability. Absorption lines should be installed on the contour. Using sandy backfill for the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

120-Koerling silt loam, 30 to 65 percent slopes. This very deep, moderately well drained soil is on terrace escarpments. It formed in glaciofluvial material, with an admixture of volcanic ash and loess, and is underlain by stratified, calcareous glacial lake sediment. Surfaces are planar. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 2,000 feet. The average annual precipitation is about 17 inches, and the average annual air temperature is about 46° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The subsoil is pale brown and light brownish gray fine sandy loam about 31 inches thick. The substratum is light gray silty clay loam to a depth of 60 inches or more. The lower part of the subsoil and the substratum are calcareous.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on side slopes of foothills
- Koerling fine sandy loam, 5 to 15 percent slopes-on edges of terrace escarpments
- Waits loam, 40 to 65 percent slopes-on side slopes of foothills in calcareous areas
- poorly drained soils in drainageways and soils adjacent to springs and seeps

The included soils make up about 20 percent of the total acreage.

The permeability of this Koerling soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. A perched water table is at a depth of 24 to 40 inches during the months of February to April.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir and, occasionally, western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 93 on the Koerling soil. The basal area is about 33 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 30 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer reduce the chances of seedling survival. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, prairie junegrass, common snowberry, and common yarrow. Overgrazing causes desirable plants, such as pinegrass and prairie junegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

121-Konner silty clay loam. This very deep, somewhat poorly drained soil is on bottom lands and in depressional areas adjacent to lakes. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, sedges, and rushes. Elevation is 1,700 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typically, the surface layer is dark gray silty clay loam about 17 inches thick. The subsoil is mottled, grayish brown clay loam about 28 inches thick. The substratum is mottled, light brownish gray silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam and Colville silt loam-on low alluvial terraces
- Narcisse silt loam-on bottom lands along streams and alluvial fans
- Peone silt loam-on alluvial fans, in depressions adjacent to lakes, and on low terraces along streams
- Hardesty silt loam-on low lying places at the base of escarpments and in depressions
- Histosols, ponded-in depressions

The included soils make up about 20 percent of the total acreage.

The permeability of this Konner soil is slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very slow. There is no hazard of water erosion, or it is slight. This soil is limited by a seasonal high water table that is at a depth of 1 foot to 2 feet during the months of February to May, and it is subject to occasional flooding for brief periods during this time.

This soil is used for nonirrigated crops and for rangeland.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, clover, and grass is wetness. In some years, spring planting may be delayed because of wetness and flooding. The proper timing of minimum tillage helps to avoid compaction. Alfalfa and winter wheat are not suited to this soil because of wetness and flooding. Proper drainage, cleaning out of channels, and protective levees help to control flooding and lower the water table. Incorporating crop residue into the surface layer helps to maintain good tilth. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by spring grain for 2 years.

This soil is suited to rangeland. The native understory vegetation is mainly reed canarygrass, tufted hairgrass, redtop, and sedge. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing should be carefully considered because wetness of the soil may limit access by livestock. Special preparation may be needed for seeding. Adapted grasses and legumes can be seeded in overgrazed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. The main limitations for septic tank absorption fields are flooding, wetness, and slow permeability. The high water table and flooding increase the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IVw, nonirrigated.

122-Konner silty clay loam, drained. This very deep, artificially drained soil is on bottom lands and in depressional areas adjacent to lakes. It formed in mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, sedges, and rushes. Elevation is 1,700 to 2,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typically, the surface layer is dark gray silty clay loam about 17 inches thick. The subsoil is mottled, grayish brown clay loam about 28 inches thick. The substratum is mottled, light brownish gray silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam and Colville silt loam-on low alluvial terraces
- Narcisse silt loam-on bottom lands along streams and alluvial fans
- Peone silt loam-on alluvial fans, in depressions adjacent to lakes, and on low terraces along streams
- Hardesty silt loam-on low lying places at the base of slope escarpments and in depressions
- Histosols, ponded-in depressions

The included soils make up about 20 percent of the total acreage.

The permeability of this Konner soil is slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal water table that is at a depth of 3 to 5 feet during the months of February to May. Runoff is very slow. There is no hazard of water erosion. Occasional brief periods of flooding can occur from February to May.

This soil is used for nonirrigated crops.

The main limitation of this soil for the production of nonirrigated oats, barley, wheat, alfalfa, and grass is wetness. Winter wheat and alfalfa can be grown on this soil, but in some years flooding may cause loss of winter wheat and alfalfa. In some years, spring planting may be delayed because of wetness. The proper timing of minimum tillage helps to avoid compaction. Protective levees and proper drainage help to control flooding and lower the water table. Incorporating crop residue into the surface layer helps to maintain good tilth. A suitable crop rotation on this soil is annual grain for 2 or 3 years followed by grass, legumes, or grass and legumes for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. The main limitations for septic tank absorption fields are flooding, wetness, and slow permeability. The high water table and flooding increase the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIIw, nonirrigated.

123-Koseth loam, 15 to 40 percent slopes. This very deep, well drained soil is on toe slopes aid foot slopes of foothills. It formed in calcareous glacial till, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 4,000 feet. The average annual precipitation is about 22 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown loam about 3 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is pale yellow gravelly loam about 28 inches thick. The lower part is pale yellow very gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

Included with this soil in mapping are areas of-

- Donavan loam, 25 to 40 percent slopes, Molcal gravelly silt loam, 25 to 40 percent slopes, and Stevens channery silt loam, 25 to 40 percent slopes-on similar landscape positions
- Aits loam, 25 to 40 percent slopes, Belzar silt loam, 25 to 40 percent slopes, and Waits loam, 25 to 40 percent slopes-on north- and east facing slopes
- Maki gravelly loam, 40 to 65 percent slopes-on convex, south- and west-facing upper slopes
- poorly drained soils in drainageways
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Koseth soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland. Cleared areas are used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Koseth soil. The basal area is about 87 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 59 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, mallow ninebark, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. Early fall seeding, minimum tillage, and fall chiseling across the slope reduce sheet and rill erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass IVe, nonirrigated.

124-Koseth loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in calcareous glacial till, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 4,000 feet. The average annual precipitation is about 22 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown loam about 3 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is pale yellow gravelly loam about 28 inches thick. The lower part is pale yellow very gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

Included with this soil in mapping are areas of-

- Donavan loam, 40 to 65 percent slopes, Molcal gravelly silt loam, 40 to 65 percent slopes, and Stevens stony silt loam, 40 to 65 percent slopes-on similar landscape positions
- Aits loam, 40 to 65 percent slopes, Belzar silt loam, 40 to 65 percent slopes, and Waits loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Maki gravelly loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- poorly drained soils in drainageways
- Rock outcrop on ridges and knobs

The included areas make up about 25 percent of the total acreage.

The permeability of this Koseth soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Koseth soil. The basal area is about 87 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 59 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger Is 71 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is manly pinegrass, Idaho fescue, bluebunch wheatgrass, mallow ninebark, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

125-Koseth-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on foot slopes and side slopes of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is trees, shrubs, forbs, and grasses. Elevation is 1,600 to 4,000 feet. The average annual precipitation is about 22 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days. This complex is about 65 percent Koseth loam, 30 to 65 percent slopes, and about 25 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Donavan loam, 40 to 65 percent slopes, Molcal gravelly silt loam, 40 to 65 percent slopes, and Stevens stony silt loam, 40 to 65 percent slopes-on similar landscape positions
- Aits loam, 40 to 65 percent slopes, Belzar silt loam, 40 to 65 percent slopes, and Waits loam, 40 to 65 percent slopes-on north- and east facing side slopes
- Maki gravelly loam, 40 to 65 percent slopes-on convex, south- and west-facing side slopes
- very shallow and very stony soils on knobs and ridges
- poorly drained soils in drainageways

The included soils make up about 10 percent of the total acreage.

The Koseth soil is very deep and well drained. It formed in glacial till, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown loam about 3 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is pale yellow gravelly loam about 28 inches thick. The lower part is pale yellow very gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

The permeability of the Koseth soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone and calcareous, shaly rock. Most areas are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Koseth soil. The basal area is about 65 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 53 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard Equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems, and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, mallow ninebark, and common snowberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

126-Laketon silt loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 23 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The subsurface layer is light brownish gray silt loam about 2 inches thick. The subsoil is pale brown and very pale brown silt loam about 25 inches thick. The upper part of the substratum is light gray silty clay loam about 10 inches thick. The lower part is light gray silt loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on similar landscape positions
- Clayton fine sandy loam, 0 to 5 percent slopes on higher terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included soils make up about 15 percent of the total acreage.

The permeability of this Laketon soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. A perched water table is at a depth of 18 to 30 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 102 on the Laketon soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 51 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, rose, and strawberry. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, clover, and grass is wetness. In some years, spring planting may be delayed because of wetness. Alfalfa and winter wheat are not suited to this soil because of wetness and flooding. Proper drainage, cleaning out of channels, and protective levees help to control flooding and lower the water table. The proper timing of minimum tillage helps to avoid compaction. Incorporating crop residue into the surface layer helps to maintain good tilth. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. The main limitation is wetness. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is the shrink-swell potential. Proper design of foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIw, nonirrigated and irrigated.

127-Laketon silt loam, 5 to 15 percent slopes. This very deep, moderately well drained soil Is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 23 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The subsurface layer is light brownish gray silt loam about 2 inches thick. The subsoil is pale brown and very pale brown silt loam about 25 inches thick. The upper part of the substratum is light gray silty clay loam about 10 inches thick. The lower part is light gray silt loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, and Laketon silt loam, 0 to 5 percent slopes-on similar landscape positions
- Clayton fine sandy loam, 5 to 15 percent slopes on higher terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 20 percent of the total acreage.

The permeability of this Laketon soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 18 to 30 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 102 on the Laketon soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 51 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, rose, and strawberry. Overgrazing causes desirable plants, such as pinegrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. Diversions or tile intercepts may be needed to overcome seeps in some areas. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat and grass-legume hay. The main limitations are the hazards of water erosion and steepness of slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitations are the shrink-swell potential and steepness of slope. Proper design of foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the moderately slow permeability. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

128-Leadpoint silt loam, 0 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes, foot slopes, and ridgetops of foothills. It formed in glacial till, residuum, and colluvium derived from shale, with an admixture of volcanic ash and loess in the surface layer. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray shaly silt loam about 15 inches thick. The substratum is black shaly loam about 14 inches thick. Below that is fractured shale at a depth of about 38 inches. The depth to weathered bedrock ranges from 20 to 40 inches. The surface layer and the underlying material are intermittently calcareous.

Included with this soil in mapping are areas of-

- calcareous Ahren loam, 2 to 20 percent slopes on side slopes of drainageways
- Aits loam, 15 to 25 percent slopes-on concave slopes
- Belzar silt loam, 5 to 25 percent slopes-on upper foot slopes and ridgetops in places of contact with limestone
- Leadpoint silt loam, 25 to 40 percent slopes-on upper foot slopes
- Smackout loam, 5 to 20 percent slopes-along drainageways and on concave slopes
- calcareous Waits loam, 15 to 25 percent slopes on concave slopes
- soils on outwash and lakebed terraces-on the lower parts of toe slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 20 percent of the total acreage.

The permeability of this Leadpoint soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. A few areas are used for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, western redcedar, grand fir, ponderosa pine, lodgepole pine, and western hemlock.

Based on a 100-year site curve, the mean site index for Douglas-fir is 93 on the Leadpoint soil. The basal area is about 65 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 50 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or grand fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, common snowberry, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, earl' fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitations are depth to rock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

129-Leadpoint silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of foothills. It formed in glacial till, residuum, aid colluvium derived from shale, with an admixture of volcanic ash and loess in the surface layer. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray shaly silt loam about 15 inches thick. The substratum is black shaly loam about 14 inches thick. Below that is fractured shale at a depth of about 38 inches. The depth to weathered bedrock ranges from 20 to 40 inches. The surface layer and the underlying material are intermittently calcareous.

Included with this soil in mapping are areas of-

- calcareous Ahren loam, 20 to 40 percent slopes on side slopes of drainageways
- Aits loam, 25 to 40 percent slopes-on concave slopes
- Belzar silt loam, 25 to 40 percent slopes-on upper foot slopes in places of contact with limestone
- Leadpoint silt loam, 0 to 25 percent slopes-on lower foot slopes
- Smackout loam, 20 to 40 percent slopes-along drainageways and on concave slopes
- calcareous Waits loam, 25 to 40 percent slopes on concave slopes
- soils on outwash and lakebed terraces-on the lower parts of foot slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Leadpoint soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, western redcedar, grand fir, ponderosa pine, lodgepole pine, and western hemlock.

Based on a 100-year site curve, the mean site index for Douglas-fir is 93 on the Leadpoint soil. The basal area is about 65 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 50 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or grand fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, common snowberry, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and depth to rock. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are depth to rock and steepness of slope. Special design s needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

130-Leadpoint silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of foothills. It formed in glacial till, residuum, and colluvium derived from shale, with an admixture of volcanic ash and loess in the surface layer. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray shaly silt loam about 15 inches thick. The substratum is black shaly loam about 14 inches thick. Below that is fractured shale at a depth of about 38 inches. The depth to weathered bedrock ranges from 20 to 40 inches. The surface layer and the underlying material are intermittently calcareous.

Included with this soil in mapping are areas of-

- calcareous Ahren loam, 40 to 65 percent slopes on side slopes of drainageways
- Aits loam, 40 to 65 percent slopes-on concave slopes
- Belzar silt loam, 40 to 65 percent slopes-on upper side slopes in places of contact with limestone
- Leadpoint silt loam, 25 to 40 percent slopes-on lower side slopes
- Smackout loam, 40 to 65 percent slopes-along drainageways and on concave slopes
- calcareous Waits loam, 40 to 65 percent slopes on concave slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 25 percent of the total acreage.

The permeability of this Leadpoint soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to western larch, western redcedar, grand fir, ponderosa pine, lodgepole pine, and western hemlock.

Based on a 100-year site curve, the mean site index for Douglas-fir is 93 on the Leadpoint soil. The basal area is about 65 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 50 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 59 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or grand fir seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, creambush oceanspray, common snowberry, and Saskatoon serviceberry.

This soil is in capability subclass VIIe, nonirrigated.

131-Leadpoint-Rock outcrop complex, 25 to 40 percent slopes. The soils in this complex are on foot slopes of foothills. Slopes are convex. The native vegetation is trees, shrubs, forbs, and grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days. This complex is about 65 percent Leadpoint silt loam, 25 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- calcareous Ahren loam, 20 to 40 percent slopes on side slopes of drainageways
- Aits loam, 25 to 40 percent slopes-on concave slopes
- Belzar silt loam, 25 to 40 percent slopes-on upper foot slopes in places of contact with limestone
- Smackout loam, 20 to 40 percent slopes-along drainageways on concave slopes
- calcareous Waits loam, 25 to 40 percent slopes on concave slopes
- soils on outwash and lakebed terraces-on the lower part of foot slopes
- very stony and very shallow soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Leadpoint soil is moderately deep and well drained. It formed in glacial till, residuum, and colluvium weathered from shale, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray shaly silt loam about 15 inches thick. The substratum is black shaly loam about 14 inches thick. Below that is fractured shale at a depth of about 38 inches. The depth to weathered bedrock is 20 to 40 inches. The surface layer and the underlying material are intermittently calcareous.

The permeability of the Leadpoint soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed limestone and calcareous shale. Most areas have steep slopes.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch, western redcedar, grand fir, ponderosa pine, lodgepole pine, and western hemlock.

Based on a 100-year site curve, the mean site index for Douglas-fir is 93 on the Leadpoint soil. The basal area is about 52 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 40 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 47 cubic feet per acre per year.

Using standard equipment with wheels or tracks on these soils causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Puddling can occur when they soils are wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or grand fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, creambush oceanspray, common snowberry, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Excavations for building sites are limited by Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are depth to rock, steepness of slope, and Rock outcrop. Special design is needed because of the limited depth of soil over the bedrock. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability, subclass VIs, nonirrigated.

132-Leadpoint-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. Slopes are convex. The native vegetation is shrubs, forbs, and grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days. This complex is about 65 percent Leadpoint silt loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- calcareous Ahren loam, 40 to 65 percent slopes along drainageways
- Aits loam, 40 to 65 percent slopes-on concave slopes

- Belzar silt loam, 40 to 65 percent slopes-on upper side slopes in places of contact with limestone
- Smackout loam, 40 to 65 percent slopes-along drainageways and on concave slopes
- calcareous Waits loam, 40 to 65 percent slopes on concave slopes
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Leadpoint soil is moderately deep and well drained. It formed in glacial till, residuum, and colluvium weathered from shale, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray shaly silt loam about 15 inches thick. The substratum is black shaly loam about 14 inches thick. Below that is fractured shale at a depth of about 38 inches. The depth to weathered bedrock ranges from 20 to 40 inches. The surface layer and the underlying material are intermittently calcareous.

The permeability of the Leadpoint soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone and calcareous shale. Most areas have steep or very steep slopes.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch, western redcedar, grand fir, ponderosa pine, lodgepole pine, and western hemlock.

Based on a 100-year site curve, the mean site index for Douglas-fir is 93 on the Leadpoint soil. The basal area is about 52 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 40 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 47 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Puddling can occur when the soils are wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or grand fir seedlings.

In most areas of these soils, the native understory vegetation is mainly pinegrass creambush oceanspray, common snowberry, and Saskatoon serviceberry.

The soils in this complex are in capability subclass Vlls, nonirrigated.

133-Maki gravelly loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of foothills. It formed in residuum, colluvium, and glacial till derived from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 4,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 130 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown gravelly loam about 8 inches thick. The subsoil is pale brown very gravelly loam about 15 inches thick. Below that is fractured shale at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Aquolls, sloping-in concave places on lower foot slopes
- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Koseth loam, 15 to 40 percent slopes-on concave slopes
- Hagen sandy loam, 15 to 40 percent slopes-on outwash terraces on lower foot slopes
- Maki gravelly loam, 40 to 65 percent slopes-on upper foot slopes
- soils on outwash and lakebed terraces-on the lower parts of foot slopes
- Rock outcrop on knobs and ridges

The included areas make up about 15 percent of the total acreage.

The permeability of this Maki soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 81 on the Maki soil. The basal area is about 42 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 24 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 30 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, pinegrass, arrowleaf balsamroot, and sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

134-Maki gravelly loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of foothills. It formed in residuum, colluvium, and glacial till derived from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 4,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 130 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown gravelly loam about 8 inches thick. The subsoil is pale brown very gravelly loam about 15 inches thick. Below that is fractured shale at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Aquolls, sloping-in concave places on lower side slopes
- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Koseth loam, 40 to 65 percent slopes-on concave slopes
- Hagen sandy loam, 15 to 40 percent slopes-on outwash terraces and terrace escarpments
- Maki gravelly loam, 25 to 40 percent slopes-on lower foot slopes
- a soil on lakebed terrace escarpments and drainage side slopes
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Maki soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 81 on the Maki soil. The basal area is about 42 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 24 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 30 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly

bluebunch wheatgrass, Idaho fescue, pinegrass, arrowleaf balsamroot, and sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

135-Maki-Rock outcrop complex, 25 to 40 percent slopes. The soils in this complex are on foot slopes of foothills. The aspect is mainly to the south arid west. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 4,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days. This complex is about 60 percent Maki gravelly loam, 25 to 40 percent slopes, and about 25 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aquolls, sloping-in concave places on lower foot slopes
- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Koseth loam, 15 to 40 percent slopes-on concave slopes
- Hagen sandy loam, 15 to 40 percent slopes-on outwash terraces on lower foot slopes
- soils on outwash and lakebed terraces-on the lower parts of foot slopes
- very stony and very shallow soils

The included areas make up about 15 percent of the total acreage.

The Maki soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till weathered from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown gravelly loam about 8 inches thick. The; subsoil is pale brown very gravelly loam about 15 inches thick. Below that is fractured shale at a depth of about 23 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

The permeability of this Maki soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed limestone and calcareous shale. Most areas are steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 81 on the Maki soil. The basal area is about 31 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 18 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 22 cubic feet per acre per year.

Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Rock outcrop limits the even distribution of reforestation. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, pinegrass, arrowleaf balsamroot, and sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to bedrock, steepness of slope, and Rock outcrop. Special design is needed because of the limited depth of soil over the bedrock. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

136-Maki-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 4,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days. This complex is about 60 percent Maki gravelly loam, 40 to 65 percent slopes, and about 25 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aquolls, sloping-in concave places on lower side slopes
- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Koseth loam, 40 to 65 percent slopes-on concave slopes
- Hagen sandy loam, 15 to 40 percent slopes-on outwash terraces and terrace escarpments
- soils on lakebed terrace escarpments and drainage side slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Maki soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till weathered from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown gravelly loam about 8 inches thick. The subsoil is pale brown very gravelly loam about 15 inches thick. Below that is fractured, calcareous shale at a depth of about 23 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

The permeability of the Maki soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone or calcareous shale. Most areas are steep or very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine also grows on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 81 on the Maki soil. The basal area is about 31 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 18 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 22 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage system; and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, pinegrass, arrowleaf balsamroot, and sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope can limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

137-Manley silt loam, 0 to 20 percent slopes. This very deep, well drained soil is on toe slopes and ridgetops of foothills. It formed in glacial till and is mantled with volcanic ash. The aspect is mainly to the north and east. Slopes are concave. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 35 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick, and the lower part is yellowish brown silt loam and very pale brown loam about 11 inches thick. The upper part of the substratum is pale olive very cobbly loam about 12 inches thick. The lower part is pale yellow extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 15 to 25 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- Buhrig very stony loam, 25 to 40 percent slopes on ridges, ridgetops, and foot slopes
- Huckleberry silt loam, 25 to 40 percent slopes on convex slopes in places of contact with shale
- glacial outwash material and soils on lakebed terraces adjacent to drainageways
- poorly drained soils in drainageways
- Rock outcrop on ridges, ridgetops, and foot slopes

The included areas make up about 20 percent of the total acreage.

The permeability of this Manley soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to grand fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Manley soil. The basal area is about 78 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is, wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are nit controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of grand fir, western larch, or Douglas-fir seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

This soil is poorly suited to homesite development. The main limitations are large stones and steepness of slope. Cobbles and large stones can hinder excavations. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are large stones and steepness of slope. Stones can hinder the placement of absorption lines. Absorption lines should be installed on the contour.

This soil is in capability subclass VIe, nonirrigated.

138-Manley silt loam, 20 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash. The aspect is mainly to the north and east. Slopes are concave. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 35 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick, and the lower part is yellowish brown silt loam and very pale brown loam about 11 inches thick. The upper part of the substratum is pale olive very cobbly loam about 12 inches thick. The lower part is pale yellow extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- Buhrig very stony loam, 25 to 40 percent slopes on ridges, ridgetops, and foot slopes
- Huckleberry silt loam, 25 to 40 percent slopes on convex slopes in places of contact with shale
- glacial outwash material and soils on lakebed terraces adjacent to drainageways
- poorly drained soils in drainageways
- Rock outcrop on ridges, ridgetops, and foot slopes

The included areas make up about 20 percent of the total acreage.

The permeability of this Manley soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to grand fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Manley soil. The basal area is about 78 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of grand fir, western larch, or Douglas-fir seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass VIe, nonirrigated.

139-Manley silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash. The aspect is mainly to the north and east. Slopes are concave. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 35 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick, and the lower part is yellowish brown silt loam and very pale brown loam about 11 inches thick. The upper part of the substratum is pale olive very cobbly loam about 12 inches thick. The lower part is pale yellow extremely stony sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Buhrig very stony loam, 40 to 65 percent slopes-on ridges, ridgetops, and side slopes
- Huckleberry silt loam, 40 to 65 percent slopes-on convex slopes in places of contact with shale
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, south- and west-facing toe slopes and foot slopes
- glacial outwash material and soils on lakebed terraces adjacent to drainageways
- poorly drained soils in drainageways
- Rock outcrop on ridges, ridgetops, and side slopes

The included areas make up about 25 percent of the total acreage.

The permeability of this Manley soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to western larch, lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Manley soil. The basal area is about 78 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 73 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 84 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, grand fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of grand fir, western larch, or Douglas-fir seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

This soil is in capability subclass VIIe, nonirrigated.

140-Manley-Rock outcrop complex, 0 to 40 percent slopes. The soils in this complex are on toe slopes, foot slopes, and ridgetops of foothills. The aspect is mainly to the north and east. Slopes are concave. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 35 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days. This complex is about 70 percent Manley silt loam, 0 to 40 percent slopes, and about 15 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- Buhrig very stony loam, 25 to 40 percent slopes on ridges, ridgetops, and foot slopes
- Huckleberry silt loam, 25 to 40 percent slopes on convex slopes in places of contact with shale
- glacial outwash material and soils on lakebed terraces adjacent to drainageways

- poorly drained soils in drainageways
- very stony and very shallow soils adjacent to Rock outcrop
- Rock outcrop on ridges, ridgetops, and foot slopes

The included areas make up about 15 percent of the total acreage.

The Manley soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown silt loam, and the lower part is yellowish brown silt loam and very pale brown loam about 11 inches thick. The upper part of the substratum is pale olive very cobbly loam about 12 inches thick. The lower part of the substratum is pale yellow extremely stony sandy loam to a depth of 60 inches or more.

The permeability of this Manley soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed granite and quartzite. Most areas are moderately steep.

The soils in this complex are used for woodland.

These soils are well suited to the production of Douglas-fir. They are also suited to grand fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Manley soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Puddling can occur when the soils are wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. 'Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, and lodgepole pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of grand fir, western larch, or Douglas-fir seedlings.

In most areas of these soils, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are slope and Rock outcrop. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

141-Manley-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east. Slopes are concave. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 35 inches, and the average annual air temperature is about 40° F. The frost-free season is 80 to 100 days. This complex is about 70 percent Manley silt loam, 40 to 65 percent slopes, and about 15 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Buhrig very stony loam, 40 to 65 percent slopes-on ridges, ridgetops, and side slopes
- Huckleberry silt loam, 40 to 65 percent slopes-on convex slopes in places of contact with shale
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, south- and west-facing toe slopes and foot slopes
- glacial outwash material and soils on lakebed terraces adjacent to drainageways
- poorly drained soils in drainageways
- Rock outcrop on ridges, ridgetops, and side slopes

The included areas make up about 15 percent of the total acreage.

The Manley soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick, and the lower part is yellowish brown silt loam and very pale brown loam about 11 inches thick. The upper part of the substratum is pale olive very cobbly loam about 12 inches thick. The lower part is pale yellow extremely stony sandy loam to a depth of 60 inches or more.

The permeability of this Manley soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite and quartzite. Most areas are moderately steep.

The soils in this complex are used for woodland.

These soils are well suited to the production of Douglas-fir. They are also suited to grand fir, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Manley soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Puddling can occur when the soils are wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, and lodgepole pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of grand fir, western larch, or Douglas-fir seedlings.

In most areas of these soils, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

The soils in this complex are in capability subclass Vlls, nonirrigated.

142-Marble loamy sand, 5 to 25 percent slopes. This very deep, excessively drained soil is on terraces that have dunelike relief. It formed in wind-worked, mixed sandy outwash material. The native vegetation is scattered conifers, forbs, and grasses. Elevation is 1,500 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed litter. The surface layer is grayish brown loamy sand about 8 inches thick. The underlying material is light brownish gray loamy sand about 22 inches thick and has a few, thin, brown lamellae. It is underlain by multicolored coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bisbee loamy fine sand, 0 to 15 percent slopes on similar landscape positions
- Dart loamy coarse sand, 0 to 8 percent slopes on planar terraces
- Hagen sandy loam, 0 to 15 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes on sloping terraces
- Hardesty silt loam-on bottom lands and in basins

The included areas make up about 20 percent of the total acreage.

The permeability of this Marble soil is rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight to moderate, and the hazard of wind erosion is high.

This soil is used for grazeable woodland. Some areas are used for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 84 on the Marble soil. The basal area is about 57 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 43 cubic feet per acre per year.

The main limitation of this soil is the loose, sandy surface layer. The loose sand hinders the use of equipment with wheels, especially when the soil is very dry.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, prairie junegrass, pinegrass, elk sedge, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, oats, barley, alfalfa, and grass is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to control erosion on nonirrigated cropland. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated grass-legume hay. The main limitations are the moderate available water capacity and the hazard of wind erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are rapid permeability and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility. Absorption lines should be installed on the contour.

This soil is in capability subclass IVe, nonirrigated and irrigated.

143-Martella silt loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper Dart of the subsoil is very pale brown silt loam about 13 inches thick, and the lower part is light gray silt loam and silty clay loam about 17 inches thick. The substratum is light gray, laminated silt loam to a depth of 60 inches or more. In places is a similar soil that is calcareous.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Clayton fine sandy loam, 0 to 5 percent, and Hodgson silt loam, 0 to 3 percent slopes-on similar landscape positions
- Aits loam, 0 to 15 percent slopes-on toe slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Martella soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Martella soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 71 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 82 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, common snowberry, spirea, and rose. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is wetness. In some years, spring planting may be delayed because of wetness. Alfalfa and winter wheat are not suited to this soil because of wetness and the hazard of flooding. Proper drainage, cleaning out of channels, and protective levees help to control flooding and lower the water table. Incorporating crop residue into the surface layer helps to maintain good tilth. Proper timing of minimum tillage helps to avoid compaction. A suitable crop rotation on this soil is annual grain for 2 to 3 years followed by alfalfa and grass for 4 to 8 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is well suited to homesite development. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

144-Martelia silt loam, 5 to 15 percent slopes. This very deep, moderately well drained soil is on undulating terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam 1/4 inch thick. The upper part of the subsoil is very pale brown silt loam about 13 inches thick, and the lower part is light gray silt loam and silty clay loam about 17 inches thick. The substratum is light gray, laminated silt loam to a depth of 60 inches or more. In places is a similar soil that is calcareous.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Clayton fine sandy loam, 5 to 15 percent slopes, Hodgson silt loam, 3 to 15 percent slopes, and Laketon silt loam, 5 to 15 percent slopes-on similar landscape positions
- Aits loam, 15 to 25 percent slopes-on toe slopes
- poorly drained soils in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Martella soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Martella soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 71 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 82 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, common snowberry, spirea, and rose. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide valuable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Diversions or tile intercepts may be needed to overcome seeps in some areas. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat and grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

145-Martella silt loam, 15 to 25 percent slopes. This very deep, moderately well drained soil is on rolling terraces. It formed in glacial lake sediment and is mantled with volcanic ash and loess. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1 /4 inch thick. The upper part of the subsoil is very pale brown silt loam about 13 inches thick, and the lower part is light gray silt loam and silty clay loam about 17 inches thick. The substratum is light gray, laminated silt loam to a depth of 60 inches or more. In places is a similar soil that is calcareous.

Included with this soil in mapping are areas of-

- Bonner silt loam, 0 to 10 percent slopes, Cedonia silt loam, 15 to 30 percent slopes, Clayton fine sandy loam, 5 to 15 percent slopes, and Hodgson silt loam, 15 to 25 percent slopes-on similar landscape positions
  Aits loam, 25 to 40 percent slopes, and Newbell silt loam, 25 to 40 percent slopes-on convex foot slopes
- poorly drained soils in drainageways

The included areas make up about 20 percent of the total acreage.

The permeability of this Martella soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 107 on the Martella soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 71 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 82 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, common snowberry, spirea, and rose. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to control erosion on nonirrigated cropland. Diversions or tile intercepts may be needed to overcome seeps in some areas. Grassed waterways help to control erosion from concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated grass-legume hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IVe, nonirrigated and irrigated.

146-Martella silt loam, 25 to 40 percent: slopes. This very deep, moderately well drained soil Is on terrace escarpments. It formed in glacial lake sediment and is mantled with volcanic ash and loess. Surfaces are planar. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper spar of the subsoil is very pale brown silt loam about 13 inches thick, and the lower part is light gray silt loam and silty clay loam about 17 inches thick. The substratum is light gray, laminated silt loam to a depth of 60 inches or more. In places is a similar soil that is calcareous.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-or convex side slopes
- Bonner silt loam, 0 to 10 percent slopes, and Hodgson silt loam, 3 to 15 percent slopes-on nearly level to sloping terraces
- poorly drained soils in depressions

The included areas make up about 25 percent of the total acreage.

The permeability of this Martella soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. A perched water table is at a depth of 24 to 36 inches during the months of February to April.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, and lodgepole pine.

Based on a 100-year site curve, the mean !site index for Douglas-fir is 107 on the Martella soil. The basal area is about 71 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 71 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 82 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, common snowberry, spirea, and rose. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are moderately slow permeability and steepness of slope. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

147-Merkel stony sandy loam, 0 to 40 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till derived mainly from granite, with an admixture of volcanic ash in the upper part. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is about 28 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is brown and pale brown stony sandy loam about 16 inches thick. The substratum is pale brown and light brownish gray very cobbly coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing foot slopes

- Merkel stony sandy loam, 40 to 65 percent slopes-on side slopes
- Newbell silt loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- soils on lakebed terrace remnants-on the lower parts of toe slopes and foot slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Merkel soil is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Merkel soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 48 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

When this soil is wet, unsurfaced roads and skid trails become sticky, slick, and almost impassable In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control Erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass VIe, nonirrigated.

148-Merkel stony sandy loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till derived mainly from granite, with an admixture of volcanic ash in the upper part. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is about 28 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is brown and pale brown stony sandy loam about 16 inches thick. The substratum is pale brown and light brownish gray very cobbly coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Merkel stony sandy loam, 0 to 40 percent slopes-on similar landscape positions
- Aits loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing side slopes
- Newbell silt loam, 40 to 65 percent slopes-on south- and west-facing slopes
- soils on lakebed terrace remnants-on the lower parts of foot slopes and side slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Merkel soil is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Merkel soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 48 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

This soil is in capability subclass VIIe, nonirrigated.

149-Merkel-Rock outcrop complex, 0 to 40 percent slopes. The soils in this complex are on toe slopes and foot slopes of foothills. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is about 28 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Merkel stony sandy loam, 0 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 25 to 40 percent slopes-or convex, north- and east-facing foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing foot slopes
- Newbell silt loam, 25 to 40 percent slopes-on south- and west-facing slopes
- soils on lakebed terrace remnants-on the lower parts of toe slopes and foot slopes
- very stony and very shallow soils

The included areas make up about 15 percent of the total acreage.

The Merkel soil is very deep and well drained. It formed in glacial till weathered mainly from granite, with an admixture of volcanic ash in the upper part. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is brown and pale brown stony sandy loam about 16 inches thick. The substratum is pale brown and light brownish gray very cobbly coarse sandy loam to a depth of 60 inches or more.

The permeability of this Merkel soil is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed granite or quartzite. Most areas are strongly sloping.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Merkel soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 46 cubic feet per acre per year.

Unsurfaced roads and skid trails become sticky, slick, and almost impassable when these soils are wet. Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by Rock outcrop. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and Rock outcrop. Rock outcrop can interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

150-Merkel-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is about 28 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Merkel stony sandy loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 40 to 65 percent slopes-or convex, north- and east-facing side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing side slopes
- Newbell silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- soils on lakebed terrace remnants-on the lower parts of foot slopes and side slopes
- very stony and very shallow soils

The included areas make up about 15 percent of the total acreage.

The Merkel soil is very deep and well drained. It formed in glacial till weathered mainly from granite, with an admixture of volcanic ash in the upper part. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is brown and pale brown stony sandy loam about 16 inches thick. The substratum is pale brown and light brownish gray very cobbly coarse sandy loam to a depth of 60 inches or more.

The permeability of this Merkel soil is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite or quartzite. Most areas are strongly sloping.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Merkel soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 46 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when these soils are wet. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings. In most areas of this soil, the native understory vegetation is mainly pinegrass, dwarf huckleberry, thimbleberry, and pachystima.

The soils in this complex are in capability subclass Vlls, nonirrigated.

151-Mobate gravelly loam, 0 to 30 percent slopes. This shallow, well drained soil is on foot slopes and ridgetops of mountains. It formed in residuum derived from granite, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown gravelly loam about 3 inches thick. The subsoil is pale brown gravelly loam about 7 inches thick. The substratum is very pale brown very gravelly sandy loam about 6 inches thick. Below that is weathered granite at a depth of about 16 inches. Depth to weathered bedrock ranges from 14 to 20 inches.

Included with this soil in mapping are areas of-

- Mobate gravelly loam, 30 to 65 percent slopes on foot slopes and side slopes
- Moscow silt loam, 0 to 25 percent slopes-on convex, north- and east-facing slopes
- Skanid loam, 0 to 25 percent slopes-on south and west-facing foot slopes and ridgetops
- Spokane loam, 0 to 25 percent slopes-on convex, south- and west-facing slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Mobate soil is moderate, and the available water capacity is low. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 81 on the Mobate soil. The basal area is about 61 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 43 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. The low available water capacity reduces the chances of seedling survival. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, spirea, ceanothus, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are the shallow depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the shallow depth to rock and steepness of slope. Special design is needed because of the very limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

152-Mobate gravelly loam, 30 to 65 percent slopes. This shallow, well drained soil is on foot slopes and side slopes of mountains. It formed in residuum derived from granite, with an admixture of volcanic ash and loess in the surface layer. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 44° F. The frost-free season is 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown gravelly loam about 3 inches thick. The subsoil is pale brown gravelly loam about 7 inches thick. The substratum is very pale brown very gravelly sandy loam about 6 inches thick. Below that is weathered granite at a depth of about 16 inches. Depth to weathered bedrock is 14 to 20 inches.

Included with this soil in mapping are areas of-

- Mobate gravelly loam, 0 to 30 percent slopes-on foot slopes and ridgetops
- Moscow silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Skanid loam, 40 to 65 percent slopes-on south and west-facing side slopes
- Spokane loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of the Mobate soil is moderate, and the available water capacity is low. The effective rooting depth is 14 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 81 on the Mobate soil. The basal area is about 61 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 35 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 43 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. The low available water capacity influences the chances of seedling survival. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, spirea, ceanothus, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

153-Molcal gravelly loam, limestone substratum, 25 to 65 percent slopes. This deep, well drained soil is on foot slopes and side slopes of foothills. It formed in material derived from calcareous shale, glacial till, and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, shrubs, and scattered conifers. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown gravelly loam about 18 inches thick. The subsoil is light gray gravelly silt loam about 4 inches thick. The substratum is light gray gravelly silt loam about 20 inches thick. Below that is weathered limestone at a depth of about 42 inches. Depth to weathered bedrock is 40 to 60 inches. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Hartill silt loam, 40 to 65 percent slopes, Maki gravelly loam, 40 to 65 percent slopes, and Spokane loam, 40 to 65 percent slopes-on convex, upper side slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave slopes
- Aquolls, sloping-on wet, concave slopes
- Spens extremely gravelly loamy sand, 25 to 65 percent slopes, and Cedonia silt loam, 30 to 65 percent slopes, on outwash and lakebed terraces-on the lower parts of foot slopes and side slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for rangeland.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is slope.

This soil is in capability subclass VIIe, nonirrigated.

154-Molcal silt loam, 0 to 8 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown silt loam about 18 inches thick. The subsoil is light gray silt loam about 4 inches thick. The substratum is light gray gravelly silt loam to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Molcal silt loam, 8 to 15 percent slopes-on toe slopes
- Republic silt loam, 0 to 8 slopes-on alluvial fans
- Scoap gravelly loam, 5 to 20 percent slopes-on convex, north- and east-facing upper toe slopes
- Stevens silt loam, 0 to 8 percent slopes-on concave, south- and west-facing slopes
- Springdale sandy loam, 0 to 15 percent slopes, and Cedonia silt loam, 0 to 5 percent slopes, on outwash and lakebed terraces-on the lower parts of toe slopes
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, oats, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to maintain good tilth, conserve moisture, and control sheet and rill erosion. Grassed waterways help to control erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat, barley, oats, grass, and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to homesite development. The main limitation for septic tank absorption fields is permeability. Using sandy material to backfill the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIe, nonirrigated and irrigated.

155-Molcal silt loam, 8 to 15 percent slopes This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown silt loam about 18 inches thick. The subsoil is light gray silt loam about 4 inches thick. The substratum is light gray gravelly silt loam to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Molcal silt loam, 0 to 8 percent slopes-on toe slopes
- Republic silt loam, 8 to 15 percent slopes-on alluvial fans
- Scoap gravelly loam, 5 to 20 percent slopes-on convex, north- and east-facing upper toe slopes
- Stevens silt loam, 8 to 15 percent slopes-on concave, south- and west-facing slopes
- Springdale sandy loam, 0 to 15 percent slopes, and Cedonia silt loam, 5 to 15 percent slopes, on outwash and lakebed terraces-on the lower parts of toe slopes
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, oats, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. Divided slope farming, stripcropping, diversions, or terraces may be needed to control erosion on nonirrigated cropland. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat, barley, oats, grass, and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and permeability. Absorption lines should be installed on the contour. Using sandy material to backfill the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

156-Molcal gravelly silt loam, 0 to 25 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown gravelly silt loam about 18 inches thick. The subsoil is light gray gravelly silt loam about 4 inches thick. The substratum is light gray gravelly silt loam to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Molcal gravelly silt loam, 25 to 40 percent slopes-on foot slopes
- Republic gravelly sandy loam, 0 to 25 percent slopes-on alluvial fans
- Scoap gravelly loam, 5 to 20 percent slopes-on convex, north- and east-facing upper toe slopes
- Stevens channery silt loam, 8 to 25 percent slopes-on concave, south- and west-facing slopes
- Springdale gravelly sandy loam, 0 to 15 percent slopes, and Cedonia silt loam, 5 to 15 percent slopes, on outwash and lakebed terraces-on the lower parts of toe slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, oats, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to maintain good tilth, conserve moisture, and control erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of applying water for the production of wheat, barley, oats, grass, and alfalfa hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid erosion, over irrigation, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and permeability. Absorption lines should be installed on the contour. Using sandy material to backfill the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

157-Molcal gravelly silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown gravelly silt loam about 18 inches thick. The subsoil is light gray gravelly silt loam about 4 inches thick. The substratum is light gray gravelly silt loam to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Molcal gravelly silt loam, 0 to 25 percent slopes on toe slopes
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 20 to 40 percent slopes-on convex, north- and east-facing upper foot slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing slopes
- Spens extremely gravelly loamy sand, 30 to 65 percent slopes, and Cedonia silt loam, 15 to 30 percent slopes, on outwash and lakebed terraces-on the lower parts of foot slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass Vle, nonirrigated.

158-Molcal gravelly silt loam, 40 to 65 percent slopes. This very deep, well drained soil is or side slopes of foothills. It formed in glacial till and glacial lake sediment and is mantled with loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,400 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown gravelly silt loam about 18 inches thick. The subsoil is light gray gravelly silt loam about 4 inches thick. The substratum is light gray gravelly silt loam to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are areas of-

- Molcal gravelly silt loam, 25 to 40 percent slopes-on foot slopes
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 40 to 65 percent slopes-on convex, north- and east-facing upper side slopes
- Stevens stony silt loam, 40 to 65 percent slopeson concave, south- and west-facing slopes
- Cedonia silt loam, 30 to 65 percent slopes, on lakebed terraces-on the lower parts of side slopes
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Molcal soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for rangeland. The native vegetation is mainly bluebunch wheatgrass and Idaho fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads or trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness of the terrain.

This soil is in capability subclass VIIe, nonirrigated.

159-Moscow silt loam, 0 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains. It formed in residuum and colluvium derived from granite and is mantled with volcanic ash and loess in the upper part. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, grasses, and forbs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 80 to 100 days.

Typically, the surface is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick over granite at a depth of 40 inches. The depth to weathered granite is 20 to 40 inches.

Included with this soil in mapping are areas of-

- Hartill silt loam, 15 to 25 percent slopes-on north- and east-facing lower slopes in places of contact with shale
- Huckleberry silt loam, 15 to 25 percent slopes on north- and east-facing upper slopes in places of contact with shale
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, south- and west-facing lower foot slopes
- Mobate gravelly loam, 0 to 30 percent slopes-on convex, upper foot slopes and ridgetops
- Moscow silt loam, 25 to 40 percent slopes-on foot slopes
- Newbell silt loam, 0 to 25 percent slopes-on convex, lower glaciated foot slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing slopes in places of contact with shale
- poorly drained soils in drainageways and areas adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Moscow soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 87 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 80 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the Use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, grand fir, and western larch lakes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. n most areas, the native understory vegetation is mainly pinegrass, snowbrush ceanothus, creambush oceanspray, and common snowberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock and steepness of slope. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are the moderate depth to rock and steepness of slope. Special design is required because of the limited depth of soil over the bedrock.

This soil is in capability subclass IIIe, nonirrigated.

160-Moscow silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of mountains. It formed in residuum and colluvium derived from granite and is mantled with volcanic ash and loess in the upper part. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, grasses, and forbs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick. Below that is granite at a depth of 40 inches. Depth to weathered granite ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Hartill silt loam, 25 to 40 percent slopes-on north- and east-facing slopes in places of contact with shale
- Huckleberry silt loam, 25 to 40 percent slopes-on north- and east-facing upper slopes in places of contact with shale
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, south- and west-facing lower toe slopes and foot slopes
- Mobate gravelly loam, 0 to 30 percent slopes-on convex, upper foot slopes and ridgetops
- Moscow silt loam, 0 to 25 percent slopes-on lower toe slopes
- Newbell silt loam, 25 to 40 percent slopes-on convex, glaciated foot slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing slopes in places of contact with shale
- Vassar silt loam, 30 to 65 percent slopes-on north- and east-facing upper side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Moscow soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 87 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 30 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 80 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, grand fir, and western larch lakes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, snowbrush ceanothus, creambush oceanspray, and common snowberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass Vle, nonirrigated.

161-Moscow silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in residuum and colluvium derived from granite and is mantled with volcanic ash and loess in the upper part. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, shrubs, grasses, and forbs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 80 to 100 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick. Below that is granite at a depth of about 40 inches. Depth to weathered granite ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Hartill silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Huckleberry silt loam, 40 to 65 percent slopes on north- and east-facing upper slopes
- Merkel stony sandy loam, 40 to 65 percent slopes-on convex, south- and west-facing lower side slopes
- Mobate gravelly loam, 30 to 65 percent slopes on convex, upper side slopes
- Moscow silt loam, 25 to 40 percent slopes-on lower foot slopes
- Newbell silt loam, 40 to 65 percent slopes-on convex, lower glaciated side slopes
- Raisio shaly loam, 20 to 65 percent slopes-on convex, south- and west-facing slopes
- Vassar silt loam, 30 to 65 percent slopes-on north- and east-facing upper side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 25 percent of the total acreage.

The permeability of this Moscow soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 87 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 68 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 80 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, grand fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, snowbrush ceanothus, creambush oceanspray, and common snow berry.

This soil is in capability subclass VIIe, nonirrigated.

162-Moscow-Rock outcrop complex, 0 to 30 percent slopes. The soils in this complex are on foot slopes and ridgetops of mountains. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 43° F. The frost-free season is about 80 to 100 days. This complex is about 65 percent Moscow silt loam, 0 to 30 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Hartill silt loam, 15 to 25 percent slopes-on north- and east-facing slopes
- Huckleberry silt loam, 15 to 25 percent slopes on north- and east-facing upper slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, south- and west-facing lower slopes
- Mobate gravelly loam, 0 to 30 percent slopes-on convex, upper foot slopes and ridgetops
- Newbell silt loam, 0 to 25 percent slopes-on convex, lower toe slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing slopes
- very stony and very shallow soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 15 percent of the total acreage.

The Moscow soil is moderately deep and well drained. It formed in granitic residuum and colluvium and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The thin subsurface layer is light gray very sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick. Below that is granite at a depth of about 40 inches. Depth to weathered granite ranges from 20 to 40 inches.

The permeability of this Moscow soil is moderate, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed granite. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 69 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 54 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 63 cubic feet per acre per year.

Using standard equipment with wheels or tracks on these soils causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, grand fir, and western larch takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, snowbrush ceanothus, creambush oceanspray, and common snowberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide valuable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the moderate depth to bedrock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

163-Moscow-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 29 inches, and the average annual air temperature is about 43° F. The frost-free season is about 80 to 100 days. This complex is about 65 percent Moscow silt loam, 30 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Hartill silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Huckleberry silt loam, 40 to 65 percent slopes-on north- and east-facing upper slopes
- Merkel stony sandy loam, 40 to 65 percent slopes-on convex, south- and west-facing lower side slopes
- Mobate gravelly loam, 30 to 65 percent slopes on convex, upper side slopes
- Newbell silt loam, 40 to 65 percent slopes-on convex, lower glaciated side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex, south- and west-facing side slopes
- Vassar silt loam, 30 to 65 percent slopes-on north- and east-facing upper side slopes
- very shallow and very stony soils
- poorly drained soils in drainageways and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Moscow soil is moderately deep and well drained. It formed in granitic residuum and colluvium and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches Thick. The thin subsurface layer is light gray very sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick. Below that is granite at a depth of about 40 inches. Depth to weathered granite ranges from 20 to 40 inches.

The permeability and available water capacity of this Moscow soil are moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite. Most areas are moderately steep.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 69 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 54 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 63 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soils are moist and displacement of the surface layer when the soils are dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. Puddling can occur when the soils are wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soils from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, grand fir, and western larch takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

In most areas of these soils, the native understory vegetation is mainly pinegrass, snowbrush ceanothus, creambush oceanspray, and common snowberry.

The soils in this complex are in capability subclass VIls, nonirrigated.

164-Narcisse silt loam. This very deep, moderately well drained soil is on bottom lands, around perimeters of lakes, and in depressional areas. It formed in mixed alluvium, with an admixture of volcanic ash and loess. Slope is 0 to 3 percent. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 90 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown silt loam about 18 inches thick. The subsoil is brown loam about 8 inches thick. The substratum is mottled, pale brown and very pale brown sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam and Chewelah fine sandy loam-on similar landscape positions
- Colville silt loam-on broad alluvial terraces
- Peone silt loam-on alluvial fans and in depressions
- Hardesty silt loam-on terraces and in depressions

The included areas make up about 20 percent of the total acreage.

The permeability of this Narcisse soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high mater table that is at a depth of 3 to 5 feet during the months of February to May. Occasional brief periods of flooding occur during these months. Runoff is very slow, and the hazard of water erosion is slight.

This soil is used for nonirrigated crops and grazeable woodland.

The main limitations of this soil for the production of nonirrigated barley, wheat, clover, alfalfa, and grasses are wetness and the hazard of flooding. Protective levees and proper drainage help to control flooding and reduce wetness. In some years, spring planting may be delayed by wetness. Incorporating crop residue into the surface layer helps to maintain good tilth. Proper timing of minimum tillage helps to avoid compaction. A suitable crop rotation on this soil is alfalfa and grasses for 4 to 8 years followed by spring grain for 2 to 3 years.

This soil is suited to the production of ponderosa pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Narcisse soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 49 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 57 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. A seasonal high water table restricts the use of equipment to midsummer or midwinter months when the soil is dry or frozen.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads may require ballasting.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. The chances of seedling survival are poor in areas that are commonly flooded. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly reed canarygrass, tufted hairgrass, redtop, sedge, and common yarrow. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is the hazard of flooding. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. The main limitations for septic tank absorption fields are the hazard of flooding and wetness. The high water table increases the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IIIw, nonirrigated.

165-Newbell silt loam, 0 to 25 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till derived mainly from granite and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light brownish gray silt loam about 1/4 inch thick. The subsoil is light yellowish brown silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 15 to 25 percent slopes-on toe slopes
- Donavan loam, 8 to 25 percent slopes-on south and west-facing foot slopes
- Eloika silt loam, 0 to 15 percent slopes-on terrace remnants
- Hartill silt loam, 15 to 25 percent slopes-on convex, north- and east-facing slopes
- Inkler gravelly silt loam, 10 to 20 percent slopes-on convex, south- and west-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, lower toe slopes and foot slopes
- Manley silt loam, 0 to 20 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 0 to 25 percent slopes-on convex slopes
- Newbell silt loam, 25 to 40 percent slopes-on upper foot slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing toe slopes
- Scrabblers very fine sandy loam, 0 to 20 percent slopes-on outwash terraces on lower foot slopes
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland. A few areas have been cleared and are used for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to western larch and ponderosa pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grasses is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling are needed to help control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation for this soil is alfalfa for 4 to 8 years followed by grain for 2 to 3 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and the moderate permeability. Absorption lines should be installed on the contour. Using sandy material to backfill the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated.

166-Newbell silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till derived mainly from granite and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light brownish gray silt loam about 1/4 inch thick. The subsoil is light yellowish brown silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 25 to 40 percent slopes-or foot slopes
- Donavan loam, 25 to 40 percent slopes-on south- and west-facing foot slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, north- and east-facing slopes
- Inkler gravelly silt loam, 20 to 40 percent slopeson convex, south- and west-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, lower toe slopes and foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Newbell silt loam, 0 to 25 percent slopes-on lower toe slopes
- Raisio shaly loam, 20 to 40 percent slopes-on south- and west-facing upper parts of foot slopes
- Scrabblers very fine sandy loam, 0 to 20 percent slopes-on outwash terraces on lower foot slopes
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to western larch and ponderosa pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIe, nonirrigated.

167-Newbell silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till derived mainly from granite and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light brownish gray silt loam about 1/4 inch thick. The subsoil is light yellowish brown silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 40 to 65 percent slopes-on side slopes
- Donavan loam, 40 to 65 percent slopes-on south- and west-facing side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, north- and east-facing upper side slopes
- Inkler gravelly silt loam, 40 to 65 percent slopes on convex, south- and west-facing side slopes
- Merkel stony sandy loam, 40 to 65 percent slopes-on convex, lower side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, upper side slopes

- Newbell silt loam, 25 to 40 percent slopes-on lower side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on south- and west-facing upper side slopes
- Scrabblers very fine sandy loam, 20 to 65 percent slopes-on terrace escarpments
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 25 percent of the total acreage.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to western larch and ponderosa pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. The location of salt licks, watering facilities, and roads and trails should be carefully considered because steepness of slope can limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

168-Newbell stony silt loam, 0 to 40 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in glacial till derived mainly from granite and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light brownish gray stony silt loam about 1/4 inch thick. The subsoil is light yellowish brown stony silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits stony loam, 0 to 40 percent slopes-on toe slopes and foot slopes
- Donavan stony loam, 0 to 30 percent slopes-on south- and west-facing slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, north- and east-facing upper foot slopes
- Inkler gravelly silt loam, 20 to 40 percent slopes-on convex, south- and west-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, lower toe slopes and foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Newbell stony silt loam, 40 to 65 percent slopeson upper foot slopes
- Raisio shaly loam, 20 to 40 percent slopes-on south- and west-facing upper foot slopes
- Scrabblers very fine sandy loam, 0 to 20 percent slopes-on terraces
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. Ponderosa pine and western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet.

The proper design of road drainage systems and care in the placement of culverts help to control Erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass Vle, nonirrigated.

169-Newbell stony silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till derived mainly from granite and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about I inch thick. The thin subsurface layer is light brownish gray stony silt loam about 1/4 inch thick. The subsoil is light yellowish brown stony silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits stony loam, 40 to 65 percent slopes-on side slopes
- Donavan stony loam, 30 to 65 percent slopes-on south- and west-facing slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, north- and east-facing upper side slopes
- Inkler gravelly silt loam, 40 to 65 percent slopes on convex, south- and west-facing slopes
- Merkel stony sandy loam, 40 to 65 percent slopes-on convex, lower side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, upper side slopes
- Newbell stony silt loam, 0 to 40 percent slopes on lower side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on south- and west-facing upper side slopes
- Scrabblers very fine sandy loam, 20 to 65 percent slopes-on outwash terrace escarpments
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges

The included areas make up about 25 percent of the total acreage.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. Ponderosa pine and western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 66 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 61 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 71 cubic feet per acre per year.

The main limitations for the harvesting of timber on this soil are steepness of slope and stones. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. The location of salt licks, watering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

170-Newbell-Rock outcrop complex, 15 to 40 percent slopes. The soils in this complex are on foot slopes of foothills. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Newbell stony silt loam, 15 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits stony loam, 0 to 40 percent slopes-on foot slopes
- Donavan stony loam, 0 to 30 percent slopes-on south- and west-facing slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, north- and east-facing upper foot slopes in places of contact with shale
- Inkler gravelly silt loam, 20 to 40 percent slopeson convex, south- and west-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on convex, lower foot slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Raisio shaly loam, 20 to 40 percent slopes-on south- and west-facing upper foot slopes in places of contact with shale
- Scrabblers very fine sandy loam, 0 to 20 percent slopes-on outwash terraces
- poorly drained soils in draws and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Newbell soil is very deep and well drained. It formed in glacial till weathered mainly from granite and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is thin, light brownish gray stony silt loam about 1/4 inch thick. The subsoil is light yellowish brown stony silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed granite. Most areas are steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine and western larch also grow on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 57 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 62 cubic feet per acre per year.

Rock outcrop on the surface can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are slope and Rock outcrop. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

171-Newbell-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 21 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 65 percent Newbell stony silt loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits stony loam, 40 to 65 percent slopes-on side slopes
- Donavan gravelly loam, 30 to 65 percent slopes on south- and west-facing slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, north- and east-facing upper side slopes in places of contact with shale
- Inkler gravelly silt loam, 40 to 65 percent slopes on convex, south- and west-facing slopes
- Merkel stony sandy loam, 40 to 65 percent slopes-on convex, lower side slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing upper slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, upper side slopes
- Raisio shaly loam, 40 to 60 percent slopes-on south- and west-facing upper side slopes in places of contact with shale
- Scrabblers very fine sandy loam, 20 to 65 percent slopes-on outwash terrace escarpments
- poorly drained soils in draws and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Newbell soil is very deep and well drained. It formed in glacial till weathered from granite aid is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light brownish gray stony silt loam about 1/4 inch thick. The subsoil is light yellowish brown stony silt loam about 13 inches thick. The substratum is light yellowish brown and very pale brown very gravelly sandy loam to a depth of 60 inches or more.

The permeability of this Newbell soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite. Most areas are steep.

These soils are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Newbell soil. The basal area is about 57 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 62 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop and stones on the surface can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails converge to avoid large outcrop of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, ninebark, ceanothus, elk sedge, and common snowberry. Overgrazing causes desirable plants, such as pinegrass and elk sedge, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

172-Peone silt loam. This very deep, poorly drained soil is on alluvial fans, bottom lands, around perimeters of lakes, and in depressional areas. It formed in volcanic ash, diatomite, and mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, and shrubs. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 18 inches, and the average air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typically, the upper part of the surface layer is gray silt loam about 6 inches thick, and the lower part is mottled, gray silt loam about 8 inches thick. The underlying material is mottled, white and light gray silt loam 29 inches thick. Below that is mottled, light gray sandy loam to a depth of 60 inches.

Included with this soil in mapping are areas of-

- Bridgeson silt loam and Colville silt loam-on broad alluvial terraces
- Hardesty silt loam-in depressions and at the foot of terrace escarpments
- Narcisse silt loam-on bottom lands along narrow drainageways in granitic areas.

The included areas make up about 20 percent of the total acreage.

The permeability of this Peone soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of .5 foot to 1.5 feet during the months of February to May. Frequent brief periods of flooding occur during these months. Runoff is very slow. There is no hazard of erosion.

This soil is used for nonirrigated crops and rangeland.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, clover, and grasses for hay and pasture are wetness and the hazard of flooding. Incorporating crop residue into the surface layer helps to maintain good tilth. Proper timing of minimum tillage helps to avoid compaction. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by spring grain for 2 years.

This soil is suited to rangeland. The native vegetation is mainly reed canarygrass, tufted hairgrass, and sedge. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing use should be carefully considered because wetness of the soil may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed areas to reduce erosion and provide desirable forage. Because of wetness, however, special treatment is needed in the preparation for seeding.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are the hazard of flooding and wetness. The high water table increases the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IVw, nonirrigated.

173-Peone silt loam, drained. This very deep, artificially drained soil is on alluvial fans, bottom lands, around perimeters of lakes, and in depressional areas. It formed in volcanic ash, diatomite, and mixed alluvium. Slope is 0 to 3 percent. The native vegetation is water-tolerant grasses, forbs, and shrubs. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 20 inches, and the average air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typically, the upper part of the surface layer is gray silt loam about 6 inches thick, and the lower part is mottled, gray silt loam about 8 inches thick. The underlying material is mottled, white and light gray silt loam about 29 inches thick. Below that is mottled, light gray sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam and Colville silt loam-on broad alluvial terraces
- Hardesty silt loam-in depressions and at the foot of terrace escarpments
- Narcisse silt loam-on bottom lands along narrow drainageways in granitic areas

The included areas make up about 20 percent of the total acreage.

The permeability of this Peone soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 3 feet during the months of February to May. Occasional brief periods of flooding occur during these months. Runoff is very slow. There is no hazard of water erosion.

This soil is used for nonirrigated crops.

The main limitations of this soil for the production of nonirrigated wheat, barley, oats, clover, and grasses for hay and pasture are wetness and flooding. Protective levees and drainage systems help to control flooding and lower the water table. Incorporating crop residue into the surface layer helps to maintain good tilth. A suitable crop rotation on this soil is annual grain for 2 to 3 years followed by grass, legumes, or grass and legumes for 4 to 8 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are the hazard of flooding and wetness. The high water table increases the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IIIw, nonirrigated.

174-Phoebe sandy loam, 0 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash materials, with an admixture of volcanic ash and loess in the upper part. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air, temperature is about 47° F. The frost-free season is 120 to 140 days.

Typically, the surface layer is dark grayish brown sandy loam about 12 inches thick. The subsoil is brown sandy loam about 9 inches thick. The upper part of the substratum is pale brown sandy loam and loamy sand about 33 inches thick. The lower part is very pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Clayton fine sandy loam, 0 to 5 percent slopes on similar landscape positions
- Dart loamy coarse sand, 0 to 8 percent slopes on undulating terraces
- Hardesty silt loam-on concave slopes and at the foot of terrace escarpments
- Hunters silt loam, 0 to 5 percent slopes-on higher terraces
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Garrison loam, 0 to 5 percent slopes -on slightly concave slopes
- Springdale sandy loam, 0 to 15 percent slopes-on undulating terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Phoebe soil is moderately rapid, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very slow. There is no hazard of water erosion, but the hazard of wind erosion is high.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 103 on the Phoebe soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 56 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 65 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally cave when the soil is saturated.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and threetip sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated barley, wheat, alfalfa, and grass is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes planted in rotation also provide excellent wind erosion control. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow for weed control.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat and alfalfa hay. The main limitation is the hazard of wind erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is well suited to homesite development. However, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIs, nonirrigated and irrigated.

175-Phoebe sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces and terrace escarpments. It formed in glacial outwash material, with an admixture of volcanic ash and loess in the upper part. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 120 to 140 days.

Typically, the surface layer is dark grayish brown sandy loam about 12 inches thick. The subsoil is brown sandy loam about 9 inches thick. The upper part of the substratum is pale brown sandy loam and loamy sand about 33 inches thick, and the lower part is very pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Clayton fine sandy loam, 5 to 15 percent slopes on similar landscape positions
- Dart loamy coarse sand, 0 to 8 percent slopes on undulating terraces
- Hardesty silt loam-on concave slopes and at the foot of terrace escarpments
- Hunters silt loam, 5 to 15 percent slopes-on higher terraces
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Garrison loam, 0 to 5 percent slopes-on slightly concave slopes
- Springdale sandy loam, 0 to 15 percent slopes-on undulating terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Phoebe soil is moderately rapid, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight, but the hazard of wind erosion is high.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean sire index for ponderosa pine is 103 on the Phoebe soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 56 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 65 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally slump when the soil is saturated.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seeding survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, arrowleal balsamroot, and threetip sagebush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated barley, wheat, alfalfa, and grass is the hazard of wind erosion. Minimum tillage and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes in rotation also provide excellent wind erosion control. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated wheat and alfalfa hay. The main limitations are the hazard of wind erosion and slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

176-Raisio shaly loam, 0 to 20 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains. It formed in material weathered from shaly rock, modified in places by glacial till and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The surface layer is grayish brown shaly loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The substratum is light brownish gray and light gray extremely flaggy loam about 21 inches thick. Below that is fractured shaly rock at a depth of about 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 15 to 25 percent slopes, and Donavan loam, 8 to 25 percent slopes-on convex, south- and west-facing toe slopes
- Hartill silt loam, 15 to 25 percent slopes-on north- and east-facing toe slopes
- Rufus shaly loam, 30 to 65 percent slopes-on convex, upper side slopes and ridges

- Scoap gravelly loam, 5 to 20 percent slopes-on convex, north- and east-facing lower toe slopes
- Stevens channery silt loam, 8 to 25 percent slopes-on concave, south- and west-facing toe slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on ridges and knobs

The included areas make up about 15 percent of the total acreage.

The permeability of this Raisio soil is moderate, and the available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 90 on the Raisio soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, eriogonum, needleandthread, arrowleaf balsamroot, and pinegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are the moderate depth to bedrock, steepness of slope, and large stones. Excavations for building sites are limited by bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Flagstones may hinder excavations. The main limitation for septic tank absorption fields is the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Absorption lines should be installed on the contour. Flagstones may hinder placement of the absorption lines.

This soil is in capability subclass VIe, nonirrigated.

177-Raisio shaly loam, 20 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of mountains. The aspect is mainly to the south and west. Slopes are convex. This soil formed in material weathered from shaly rock, modified in places by glacial till and volcanic ash. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The surface layer is grayish brown shaly loam 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The substratum is light brownish gray and light gray extremely flaggy loam about 21 inches thick. Below that is fractured shaly rock at a depth of about 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on convex, south- and west-facing upper foot slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Rufus shaly loam, 30 to 65 percent slopes-on convex, upper side slopes and ridges
- Scoap gravelly loam, 20 to 40 percent slopes-on convex, north- and east-facing lower foot slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing slopes
- poorly drained soils in drainageways and areas adjacent to seeps and springs
- Rock outcrop on ridges and knobs and talus on upper side slopes

The included areas make up about 20 percent of the total acreage.

The permeability of this Raisio soil is moderate, and the available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 90 on the Raisio soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

In winter, snowpack hinders the use of equipment on this soil and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, eriogonum, needleandthread, arrowleaf balsamroot, and pinegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. Flagstones may hinder excavations. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. The steepness of slope is a concern in installing septic tank absorption fields. Flagstones may hinder placement of the absorption lines.

This soil is in capability subclass VIe, nonirrigated.

178-Raisio shaly loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in material weathered from shaly rock, modified in places by glacial till and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47° F. The frost-free season is 90 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The surface layer is grayish brown shaly loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The substratum is light brownish gray and light gray extremely flaggy loam about 21 inches thick. Below that is fractured shaly rock at a depth of about 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Donavan loam, 40 to 65 percent slopes-on convex, south- and west-facing lower side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, north- and east-facing lower side slopes
- Rufus shaly loam, 30 to 65 percent-on convex, upper side slopes and ridges
- Scoap gravelly loam, 40 to 65 percent slopes, on convex, north- and east-facing lower side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop on knobs and ridges and talus on upper side slopes

The included areas make up about 25 percent of the total acreage.

The permeability of this Raisio soil is moderate, and the available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. Ponderosa pine also grows on this soil.

Based on a 100-year site curve, the mean site index for Douglas-fir is 90 on the Raisio soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 43 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, eriogonum, needleandthread, arrowleaf balsamroot, and pinegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

179-Raisio-Rock outcrop complex, 25 t-o 40 percent slopes. The soils in this complex are on foot slopes and ridgetops of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days. This complex is about 65 percent Raisio shaly loam, 25 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart gravelly sandy loam, 20 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on convex, south- and west-facing lower foot slopes
- Hartill silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Rufus shaly loam, 30 to 65 percent slopes-on convex, upper foot slopes and ridges
- Scoap gravelly loam, 20 to 40 percent slopes-on convex, north- and east-facing lower slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- talus on upper foot slopes

The included areas make up about 15 percent of the total acreage.

The Raisio soil is moderately deep and well drained. It formed in material weathered from shaly rock, modified in places by glacial till and volcanic ash. Slopes are convex. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The surface layer is grayish brown shaly loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The substratum is light brownish gray and light gray extremely flaggy loam about 21 inches thick. Below that is fractured shaly rock at a depth of about 30 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Raisio soil is moderate, and the available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed shale. Most areas are steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine also grows on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 90 on the Raisio soil. The basal area is about 48 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 41 cubic feet per acre per year.

Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, needleandthread, arrowleaf balsamroot, and pinegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. Flagstones may hinder excavations. The main limitations for septic tank absorption fields are the moderate depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock. Rock outcrop interferes with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

180-Raisio-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,800 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days. This complex is about 65 percent Raisio shaly loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Donavan loam, 40 to 65 percent slopes-on convex, south- and west-facing lower side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Rufus shaly loam, 30 to 65 percent slopes-on convex, upper side slopes and ridges
- Scoap gravelly loam, 40 to 65 percent slopes-on convex, north- and east-facing lower slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- talus on upper side slopes

The included areas make up about 15 percent of the total acreage.

The Raisio soil is moderately deep and well drained. It formed in material weathered from shaly rock, modified in places by glacial till and volcanic ash. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The surface layer is grayish brown shaly loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The substratum is light brownish gray and light gray extremely flaggy loam about 21 inches thick. Below that is fractured shaly rock at a depth of 30 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Raisio soil is moderate, and the available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed shale. Most areas are steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine also grows on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 90 on the Raisio soil. The basal area is about 48 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 41 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict 1he use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, needleandthread, arrowleaf balsamroot, and pinegrass. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

181-Rathdrum silt loam. This very deep, well drained soil is on terraces in depressional areas. It formed in alluvial material derived from volcanic ash and loess and is underlain by glacial outwash material. Slope is 0 to 3 percent. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1/2 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is very pale brown silt loam about 14 inches thick. The substratum is very pale brown and light gray very fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Aits loam, 0 to 15 percent slopes-on toe slopes
- Bonner silt loam, 0 to 10 percent slopes-on terraces

- Eloika silt loam, 0 to 15 percent slopes-on higher terraces

The included areas make up about 20 percent of the total acreage.

The permeability of this Rathdrum soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very slow. There is no hazard of water erosion. This soil is subject to rare flooding during the months of February to May.

This soil is used for grazeable woodland aid for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir, lodgepole pine, and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Rathdrum soil. The basal area is about 60 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 53 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 61 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Roads need ballasting for year-round use.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. However, the chances of seedling survival are poor in areas that are commonly flooded. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine, lodgepole pine, or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, pachystima, thimbleberry, sedge, and snowberry. Overgrazing causes desirable plants, such as pinegrass and sedge, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage,

This soil is well suited to the production of irrigated and nonirrigated wheat, barley, alfalfa, and grasses. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated wheat, grass, and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is the hazard of flooding. Dikes and channels can protect absorption fields from being flooded.

This soil is in capability subclass IIIc, nonirrigated and irrigated.

182-Republic gravelly sandy loam, 0 to 25 percent slopes. This very deep, well drained soil is on alluvial fans and toe slopes of foothills. It formed in alluvium and glacial till, with an admixture of loess and volcanic ash. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 95 to 110 days.

Typically, the surface layer of this soil is grayish brown and brown gravelly sandy loam about 18 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is light yellowish brown gravelly loam about 7 inches thick. The lower part is pale yellow gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 5 to 15 percent slopes-on undulating terraces
- Garrison loam, 0 to 5 percent slopes-on terraces
- Hodgson silt loam, 15 to 25 percent slopes-on undulating terraces and terrace escarpments
- Hunters silt loam, 0 to 5 percent slopes-on concave terraces
- Martella silt loam, 5 to 15 percent slopes-on concave lakebed terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Republic soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Republic soil. The basal area is about 99 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 105 cubic feet per acre per year.

This soil has no limitations for use of equipment.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads may need ballasting for year-round use.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during the critical erosion period helps to conserve moisture, maintain good tilth, and control erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of applying water for the production of irrigated grass and alfalfa hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass IVe, nonirrigated and irrigated.

183-Republic gravelly sandy loam, 25 to 40 percent slopes. This very deep, well drained soil is on alluvial fans and foot slopes of foothills. It formed in alluvium and glacial till, with an admixture of loess and volcanic ash. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 95 to 110 days.

Typically, the surface layer of this soil is grayish brown and brown gravelly sandy loam about 18 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is light yellowish brown gravelly loam about 7 inches thick. The lower part is pale yellow gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 15 to 30 percent slopes-on rolling terraces and terrace escarpments
- Garrison loam, 5 to 15 percent slopes-on convex terraces
- Hodgson silt loam, 25 to 40 percent slopes-on convex terraces and terrace escarpments
- Hunters silt loam, 5 to 15 percent slopes-on concave terraces
- Martella silt loam, 25 to 40 percent slopes-on terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Republic soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Republic soil. The basal area is about 99 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 105 cubic feet per acre per year.

The main limitation for use of equipment is steepness of slope.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Ballasting is needed for year-round use.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue.

Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass IVe, nonirrigated.

184-Republic silt loam, 0 to 8 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium and glacial till, with an admixture of loess and volcanic ash. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 43° F. The frost-free season is 95 to 110 days.

Typically, the surface layer is grayish brown and brown silt loam about 18 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is light yellowish brown gravelly loam about 7 inches thick. The lower part is pale yellow gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Garrison loam, 0 to 5 percent slopes, and Hunters silt loam, 0 to 5 percent slopes-on similar landscape positions
- Cedonia silt loam, 0 to 5 percent slopes-on undulating lakebed terraces
- Hodgson silt loam, 0 to 3 percent slopes-on convex terraces
- Martella silt loam, 0 to 5 percent slopes-in concave places on lakebed terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Republic soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Republic soil. The basal area is about 99 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 105 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads need ballasting for year-round use.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue: Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to conserve moisture, maintain tilth, and control erosion. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to homesite development.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

185-Republic silt loam, 8 to 15 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium and glacial till, with an admixture of loess and volcanic ash. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 43° F. The frost-free season is 95 to 110 days.

Typically, the surface layer is grayish brown and brown silt loam about 18 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is light yellowish brown gravelly loam about 7 inches thick. The lower part is pale yellow gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Garrison loam, 5 to 15 percent slopes, and Hunters silt loam, 3 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes-on undulating lakebed terraces
- Hodgson silt loam, 3 to 15 percent slopes-on convex terraces
- Martella silt loam, 5 to 15 percent slopes-on concave slopes on lakebed terraces

The included areas make up about 15 percent of the total acreage.

The permeability of this Republic soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland arid for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Republic soil. The basal area is about 99 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 105 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads need ballasting for year-round use.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease arid less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to conserve moisture, maintain tilth, and control erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation for septic tank absorption fields is steepness of slope. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

186-Republic silt loam, 15 to 40 percent slopes. This very deep, well drained soil is on alluvial fans and terrace escarpments. It formed in alluvium and glacial till, with an admixture of loess and volcanic ash. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. Elevation is 1,600 to 3,500 feet. The average annual precipitation is about 16 inches, and the average annual air temperature is about 43° F. The frost-free season is 95 to 110 days.

Typically, the surface layer is grayish brown and brown silt loam about 18 inches thick. The subsoil is pale brown gravelly loam about 13 inches thick. The upper part of the substratum is light yellowish brown gravelly loam about 7 inches thick. The lower part is pale yellow gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Garrison loam, 5 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 15 to 30 percent slopes-on rolling lakebed terraces
- Hodgson silt loam, 25 to 40 percent slopes-on undulating terraces and terrace escarpments
- Hunters silt loam, 3 to 15 percent slopes-on concave terraces
- Martella silt loam, 25 to 40 percent slopes-on lakebed terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Republic soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is well suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102 on the Republic soil. The basal area is about 99 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 105 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent. Ballasting may be needed for year-round use.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, and rough fescue. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to conserve moisture, maintain tilth, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass-legume hay. The main limitations are steepness of slope and the hazard of water erosion. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass IVe, nonirrigated and irrigated.

187-Riverwash. Riverwash is on bottom lands along perennial and intermittent streams. It consists of unstabilized sandy, silty, clayey, or gravelly sediment that is frequently washed and reworked by streams or rivers. It supports little or no vegetation. Riverwash has little value other than serving as protection against channel cutting and as a source of sand and gravel. It has limited use as wildlife habitat. The sparse vegetation consists of shrubs, weedy plants, and deciduous trees.

This map unit is poorly suited to homesite development because it is subject to frequent flooding and is made up of unstabilized material.

This map unit is in capability subclass VIIIs, nonirrigated.

188-Rock outcrop. Rock outcrop consists of areas in which exposed bedrock covers 90 percent or more of the surface. These areas are mainly on ridgetops and side slopes. Slope is 50 to 90 percent. Some areas of Rock outcrop are large and are broken by small areas of soil. Most outcroppings of rock are hard, but some are soft. These areas have sparse vegetation, and they are principally used as habitat for wildlife and for mining.

This map unit is poorly suited to homesite development because excavations for building sites are limited by bedrock.

This map unit is in capability subclass VIIIs, nonirrigated.

189-Rock outcrop-Aits complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days. This complex is about 50 percent Rock outcrop and about 35 percent Aits stony loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Newbell silt loam, 40 to 65 percent slopes-on similar landscape positions
- Donavan loam, 40 to 65 percent slopes-on convex, south- and west-facing side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex side slopes

- Inkler gravelly silt loam, 40 to 65 percent slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed granite, quartzite, or shaly bedrock. Most areas are very steep.

The Aits soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is brown stony loam about 2 inches thick. The subsoil is brown stony loans about 10 inches thick. The upper part of the substratum is light gray or grayish brown gravelly loam about 33 inches thick. The lower part is pale olive, very gravelly clay loam to a depth of 60 inches or more.

The permeability of this Aits soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Aits soil. The basal area is about 35 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 38 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rocks.

The reforestation of cutover areas of Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, spirea, common snowberry, and ninebark. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

190-Rock outcrop-Donavan complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 46° F. The frost-free season is about 90 to 120 days. This complex is about 50 percent Rock outcrop and about 35 percent Donavan stony loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes-on similar landscape positions
- Raisio shaly loam, 40 to 65 percent slopes, and Rufus shaly loam, 30 to 65 percent slopes-on convex, upper side slopes
- Spokane stony loam, 40 to 65 percent slopes, on convex, south- and west-facing slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing foot slopes
- very stony and very shallow soils

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed granite, shale, or andesite. Most areas are steep to very steep.

The Donavan soil is very deep and well drained. It formed in glacial till, with an admixture of volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The upper part of the surface layer is grayish brown stony loam about 6 inches thick. The lower part is brown gravelly loam about 8 inches thick. The underlying material is pale brown and light gray, cobbly sandy loam to a depth of 60 inches or more.

The permeability of this Donavan soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. They are also suited to western larch and Douglasfir.

Based on a 100-year site curve, the mean site index for ponderosa pine is 107 on the Donavan soil. The basal area is about 27 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 27 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 31 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine, western larch, and Douglas-fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, western larch, or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

191-Rock outcrop-Huckleberry complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is about 32 inches, and the average annual air temperature is about 43° F. The frost-free season is about 70 to 90 days. This complex is about 55 percent Rock outcrop and about 30 percent Huckleberry silt loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Ahren loam, 40 to 65 percent slopes-on side slopes along drainageways
- Belzar silt loam, 40 to 65 percent slopes-on convex, upper foot slopes
- Buhrig very stony loam, 40 to 65 percent slopes on upper side slopes
- Hartill silt loam, 40 to 65 percent slopes-on convex side slopes at lower elevations
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing side slopes
- Vassar silt loam, 30 to 65 percent slopes-on convex side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed shale or quartzite. Most areas are steep to very steep.

The Huckleberry soil is moderately deep and well drained. It formed in colluvium and residuum weathered from shale and phyllite and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 2 inches thick. The surface layer is pale brown silt loam about 6 inches thick. The subsoil is pale brown silt loam about 8 inches thick. The upper part of the substratum is pale brown, shaly silt loam about 7 inches thick, and the lower part is pale brown and light brownish gray, very shaly loam about 11 inches thick. Phyllite is at a depth of about 32 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Huckleberry soil is moderate, and the available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to western larch, lodgepole pine, western white pine, and grand fir.

Based on a 100-year site curve, the mean site index for Douglas-fir is 88 on the Huckleberry soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at

80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 45 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, grand fir, and western white pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western larch seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, creambush oceanspray, vine maple, and thimbleberry.

The soils in this complex are in capability subclass VIIs, nonirrigated.

192-Rock outcrop-Inkler complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 55 percent Rock outcrop and about 30 percent Inkler gravelly silt loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Merkel stony sandy loam, 40 to 65 percent slopes-on similar landscape positions
- Aits loam, 40 to 65 percent slopes, and Newbell silt loam, 40 to 65 percent slopes-on concave side slopes
- Hartill silt loam, 40 to 65 percent slopes-on upper side slopes
- Kiehl gravelly silt loam, 20 to 65 percent slopes on remnant outwash terrace escarpments and side slopes of drainageways
- soils on lakebed terraces on the lower parts of side slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrops consists of areas of exposed granite or andesite. Most areas are steep or very steep.

The Inkler soil is very deep and well drained. It formed in glacial till, colluvium, and residuum, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface is gray gravelly silt loam about 4 inches thick. The subsoil is pale brown gravelly silt loam about 17 inches thick. The upper part of the substratum is light brownish gray very gravelly loam and very cobbly loam about 25 inches thick. The lower part is pale yellow, very cobbly sandy clay loam to a depth of 60 inches or more.

The permeability of this Inkler soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine, lodgepole pine, and western larch also grow on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 103 on the Inkler soil. The basal area is about 27 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 25 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 29 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir or ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass VIIs, nonirrigated.

193-Rock outcrop-Maki complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,400 to 4,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days. This complex is about 55 percent Rock outcrop and about 30 percent Maki gravelly loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Aquolls, sloping-on concave, lower side slopes
- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Koseth loam, 40 to 65 percent slopes-on concave slopes
- Cedonia silt loam, 30 to 65 percent slopes-on lakebed terraces and terrace escarpments and on drainage side slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed shale or limestone. Most areas are very steep.

The Maki soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till weathered from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is pale brown gravelly loam about 8 inches thick. The subsoil is pale brown, very gravelly loam about 15 inches thick. Below that is fractured shale at a depth of about 23 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Maki soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of Douglas-fir. Ponderosa pine also grows on these soils.

Based on a 100-year site curve, the mean site index for Douglas-fir is 81 on the Maki soil. The basal area is about 19 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 11 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 13 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, Idaho fescue, pinegrass, arrowleaf balsamroot, and sagebrush. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

194-Rock outcrop-Merkel complex, 30 to 50 percent slopes. The soils in this complex are on side slopes of foothills. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is about 28 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 120 days. This complex is about 55 percent Rock outcrop and about 30 percent Merkel stony sandy loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Aits stony loam, 40 to 65 percent slopes-on convex, north- and east-facing slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing side slopes
- Newbell silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Martella silt loam, 25 to 40 percent slopes-on lakebed terraces on lower parts of side slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed granite or quartzite. Most areas are steep.

The Merkel soil is very deep and well drained. It formed in glacial till weathered mainly from granite, with an admixture of volcanic ash. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The subsoil is brown and pale brown, stony sandy loam about 16 inches thick. The substratum is pale brown and light brownish gray, very cobbly coarse sandy loam to a depth of 60 inches or more.

The permeability of this Merkel soil is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean rite index for Douglas-fir is 88 on the Merkel soil. The basal area is about 32 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 22 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 26 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop on the surface can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

The soils in this complex are in capability subclass Vlls, nonirrigated.

195-Rock outcrop-Moscow complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. The native vegetation is conifers, grasses, forbs, and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 43° F. The frost-free season is about 80 to 100 days. This complex is about 55 percent Rock outcrop and about 30 percent Moscow silt loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Hartill silt loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Huckleberry silt loam, 40 to 65 percent slopes on north- and east-facing upper side slopes
- Merkel stony loam, 40 to 65 percent slopes-on convex, south- and west-facing lower side slopes
- Mobate gravelly loam, 30 to 65 percent slopes on convex, upper side slopes
- Newbell silt loam, 40 to 65 percent slopes-on convex, lower glaciated side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex, south- and west-facing upper side slopes
- Vassar silt loam, 30 to 65 percent slopes-on north- and east-facing upper side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs

- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed granite, gneiss, or schist. Most areas are steep or very steep.

The Moscow soil is moderately deep and well drained. It formed in granitic residuum and colluvium and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 1/2 inches thick. The thin subsurface layer is light gray very fine sandy loam about 1/4 inch thick. The upper part of the subsoil is pale brown and yellowish brown silt loam about 14 inches thick, and the lower part is pale brown sandy loam about 12 inches thick. The substratum is pale yellow granitic gruss about 14 inches thick. Below that is weathered granite at a depth of about 40 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

The permeability and available water capacity of this Moscow soil are moderate. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for woodland.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine, grand fir, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 94 on the Moscow soil. The basal area is about 39 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 30 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 36 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations. Unsurfaced roads and skid trails become sticky, slick, and almost impassable when the soil is wet. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut aid fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, ponderosa pine, western larch, and grand fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

In most areas of this soil, the native understory vegetation is mainly pinegrass, creambush oceanspray, snowbrush ceanothus, and common snowberry.

The soils in this complex are in capability subclass VIIs, nonirrigated.

196-Rock outcrop-Spokane complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, shrubs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 130 days. This complex is about 55 percent Rock outcrop and about 30 percent Spokane stony loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Bernhill very stony loam, 40 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes-on complex side slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Skanid loam, 40 to 65 percent slopes-on convex, south- and west-facing knobs, ridges, and ridgetops
- Cedonia silt loam, 30 to 65 percent slopes, and Spens stony loamy sand, 25 to 40 percent slopes-on outwash and lakebed terraces
- very shallow and very stony soils on knobs, ridges, and ridgetops
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed granite. Most areas are very steep.

The Spokane soil is moderately deep and well drained. It formed in material weathered from granite, with an admixture of volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 31 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 23 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 27 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict tie use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop on the surface can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, common yarrow, and willow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

197-Rock outcrop-Stevens complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, shrubs, and conifers. The elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days. This complex is about 55 percent Rock outcrop and about 30 percent Stevens stony silt loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Donavan stony loam, 30 to 65 percent slopes, and Stevens channery silt loam, 25 to 40 percent slopes-on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Dehart cobbly loam, 40 to 65 percent slopes, and Leadpoint silt loam, 40 to 65 percent slopes
- Molcal gravelly loam, 30 to 65 percent slopes, and Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 40 to 65 percent slopes-on north- and east-facing side slopes
- Aquolls, sloping-on concave slopes
- very stony and very shallow soils
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed shale or slate. Most areas are very steep.

The Stevens soil is very deep and well drained. It formed in mixed glacial till, with an admixture of volcanic ash and loess. Typically, the surface layer is dark gray and dark grayish brown, stony silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex are used for rangeland.

These soils are suited to rangeland. The native vegetation is mainly bluebunch wheatgrass, Idaho fescue, and balsamroot. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass VIIs, nonirrigated.

198-Rock outcrop-Thout complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 90 to 110 days. This complex is about 55 percent Rock outcrop and about 30 percent Thout gravelly loam, 30 to 65 percent slopes.

Included with this complex in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell stony silt loam-on convex, north- and east-facing slopes
- Buhrig very stony loam, 40 to 65 percent slopes-on upper slopes and ridgetops
- Inkier gravelly silt loam, 20 to 40 percent slopes-on south- and west-facing foot slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on foot slopes
- Scoap gravelly loam, 20 to 40 percent slopes-on north- and east-facing foot slopes
- poorly drained soils in concave drainageways
- very stony and very shallow soils near Rock outcrop
- talus on very steep slopes below Rock outcrop

The included areas make up about 15 percent of the total acreage.

Rock outcrop consists of areas of exposed andesite. Most areas are steep.

The Thout soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till, with an admixture of volcanic ash. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is grayish brown and pale brown gravelly loam about 9 inches thick. The subsoil is light yellowish brown very gravelly loam about 7 inches thick. The substratum is yellowish brown very gravelly loam about 8 inches thick. Andesite is at a depth of about 24 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Thout soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The soils in this complex have poor potential for the production of ponderosa pine and for Douglas-fir, which also grows on these soils.

Based on a 100-year site curve, the mean site index for ponderosa pine is estimated to be 75 on the Thout soil. The basal area will develop to about 18 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 9 cubic feet per acre per year. The CMAI at 45 years of trees 0.6 inch dbh and larger is 11 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In winter, snowpack hinders the use of equipment and limits access. Rock outcrop causes breakage of timber and hinders yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush and grass species that are not controlled will delay the establishment of natural reforestation. Rock outcrop limits the even distribution of reforestation. The seedling mortality rate may be high during the summer months due to the lack of soil moisture. Areas also can be reforested by the planting of ponderosa pine and Douglas-fir seedlings.

These soils are suited to grazing and browsing. The native understory vegetation is mainly bluebunch wheatgrass, common yarrow, and Saskatoon serviceberry. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

199-Rufus shaly loam, 30 to 65 percent slopes. This shallow, well drained soil is on side slopes and ridgetops of mountains. It formed in residuum and colluvium derived from shaly rock, modified in places by glacial till and mixed with volcanic ash and loess. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and scattered conifers (fig. 10). Elevation is 1,800 to 4,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typically, the surface layer is grayish brown shaly loam about 4 inches thick. The underlying material is brown and grayish brown, very flaggy and extremely flaggy loam about 10 inches thick. Shaly rock is at a depth of

Figure 10.-Rufus shaly loam, 30 to 65 percent slopes, on south-facing ridges. This soil supports scattered conifers and has a cover of sparse grass. Bedrock is between a depth of 10 and 20 inches.

about 14 inches. Depth to bedrock ranges from 10 to 20 inches.

Included with this soil in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes-on south- and west-facing lower side slopes
- Donavan loam, 40 to 65 percent slopes-on south- and west-facing foot slopes
- Maki gravelly loam, 40 to 65 percent slopes-on south- and west-facing upper side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex and planar, lower side slopes
- Rock outcrop on knobs and ridges
- talus downslope from Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Rufus soil is moderate, and the available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is poorly suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 70 on the Rufus soil. The basal area is about 29 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 13 cubic feet per acre per year. The CMAI at 50 years of trees 0.6 inch dbh and larger is 16 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on

this soil. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. The high soil surface temperatures in summer and the very low available water capacity reduce the chances of seedling survival. Trees are occasionally subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing In most areas, the native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, lupine, and arrowleaf balsamroot. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slopes may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

200-Rufus-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on side slopes and ridgetops of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is grasses, forbs, and conifers. Elevation is 1,800 to 4,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days. This complex is about 65 percent Rufus shaly loam, 30 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart gravelly sandy loam, 40 to 65 percent slopes, and Donavan loam, 40 to 65 percent slopes-on south- and west-facing lower side slopes
- Maki gravelly loam, 40 to 65 percent slopes-on south- and west-facing upper side slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex and planar, lower side slopes
- talus downslope from Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Rufus soil is shallow and well drained. It formed in residuum and colluvium weathered from shaly rock, modified in places by glacial till and mixed with volcanic ash and loess. Typically, the surface layer is grayish brown shaly loam about 4 inches thick. The underlying material is brown and grayish brown, very flaggy and extremely flaggy loam about 10 inches thick. Shale is at a depth of about 14 inches. Depth to bedrock ranges from 10 to 20 inches.

The permeability of this Rufus soil is moderate, and the available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed shale. Most areas are very steep.

The soils in this complex are used for grazeable woodland.

These soils are poorly suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 70 on the Rufus soil. The basal area is about 23 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 10 cubic feet per acre per year. The CMAI at 50 years of trees 0.6 inch dbh and larger is 13 cubic feet per acre per yard.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high surface soil temperatures in summer and the very low available water capacity reduce the chances of seedling survival. Trees are occasionally subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly Idaho fescue, bluebunch wheatgrass, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. Seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass VIIs, nonirrigated.

201-Saltese muck. This very deep, very poorly drained, organic soil is in basins and potholes, on bottom lands, and along the perimeters of lakes. It formed in decomposed remains of reeds, sedges, and other hydrophyllic plant material, with an admixture of alluvium, diatomite, and volcanic ash. Slope is 0 to 2 percent. The native vegetation is water-tolerant grasses, cattails, sedges, and rushes. Elevation is 2,000 to 2,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 110 days.

Typically, the surface tier is dark reddish brown muck about 5 inches thick. The next tier is dark reddish brown sapric material about 37 inches thick. The bottom tier is olive brown sapric material to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam, Chewelah fine sandy loam, Colville silt loam, Konner silty clay loam, Narcisse silt loam, and Peone silt loam-on similar landscape positions
- Bossburg muck-on bottom lands and along drainageways

The included areas make up about 15 percent of the total acreage.

The permeability of this Saltese soil is moderate, and the available water capacity is very high. The effective rooting depth is limited by the seasonal high water table that is at or near the surface to a depth of 1/2 foot during the months of February to May. Long periods of ponding can occur during these months. Runoff is ponded. There is no hazard of water erosion.

This soil is used for rangeland. The native vegetation is mainly reed canarygrass, tufted hairgrass, redtop, and sedge. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. The time of grazing use should be specially considered because wetness of the soil may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed areas to reduce erosion and provide desirable forage. However, special techniques are needed for seeding.

This soil is poorly suited to homesite development. The main limitations are ponding, wetness, and low strength. Buildings should be located above the expected ponding level. Channels can protect homesites from ponding. Drainage is needed if buildings are constructed on this soil. Buildings should be designed to offset the limited ability of the soil to support a load. The main limitations for septic tank absorption fields are ponding and wetness. The high water table increases the possibility of failure of septic tank absorption fields.

This soil is in capability subclass Vw, nonirrigated.

202-Saltese muck, drained. This very deep, artificially drained, organic soil is in basins and potholes, on bottom lands and along the perimeters of lakes. It formed in decomposed remains of reeds, sedges, and other plant material, with an admixture of alluvium, diatomite, and volcanic ash. Slope is 0 to 2 percent. The native vegetation is water-tolerant grasses, cattails, sedges, and rushes. Elevation is 2,000 to 2,500 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 100 to 110 days.

Typically, the surface tier is dark reddish brown muck about 5 inches thick. The next tier is dark reddish brown sapric material about 37 inches thick. The bottom tier is olive brown sapric material to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam, Chewelah fine sandy loam, Colville silt loam, Konner silty clay loam, Narcisse silt loam, and Peone silt loam-on similar landscape positions
- Bossburg silt loam-on bottom lands and along drainageways

The included areas make up about 15 percent of the total acreage.

The permeability of this Saltese soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more, but it is limited by the seasonal high water table that is at a depth of 1 foot to 4 feet during the months of February to May. Occasional long periods of ponding can occur during these months. Runoff is ponded. There is no hazard of water erosion.

This soil is used for nonirrigated and irrigated crops.

The main limitation of this soil for the production of oats, grass, and clover is wetness. Spring planting may be delayed in some years. The soil can be drained by tile or open ditches if outlets are available. Subsidence is minimized if the water table is maintained immediately below the root zone and allowed to return to the surface during the nongrowing season. Protective levees help to control flooding. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by annual grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding, wetness, and low strength. Buildings should be located above the expected flood level. Dikes and channels can protect homesites from being flooded. Drainage is needed if buildings are constructed on this soil. Buildings should be designed to offset the limited ability of the soil to support a load. The main limitations for septic tank absorption fields are flooding and wetness. The high water table increases the possibility of failure of septic tank absorption fields.

This soil is in capability subclass IIIw, nonirrigated.

203-Scoap gravelly loam, 5 to 20 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and colluvium, with an admixture of volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses.

Elevation is 1,500 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 2 inches thick. The surface layer is dark gray and grayish brown gravelly loam about 13 inches thick. The upper part of the subsoil is brown gravelly loam about 13 inches thick, and the lower part is pale brown and light yellowish brown very cobbly loam about 17 inches thick. The substratum is very pale brown very stony loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan loam, 8 to 25 percent slopes-on convex, south- and west-facing slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing upper toe slopes
- Scoap gravelly sandy loam, 20 to 40 percent slopes-on upper foot slopes
- Stevens silt loam, 8 to 15 percent slopes-on concave, south- and west-facing slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Scoap soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Scoap soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, prairie junegrass, lupine, and mallow ninebark. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated barley, wheat, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface helps to maintain good tilth, conserve moisture, and control erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. In addition, stones and cobbles can hinder excavations. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is steepness of slope. Stones may hinder placement of the absorption lines. Absorption lines should be installed on the contour.

This soil is in capability subclass IIIe, nonirrigated.

204-Scoap gravelly loam, 20 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and colluvium, with an admixture of volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 2 inches thick. The surface layer is dark gray and grayish brown gravelly loam about 13 inches thick. The upper part of the subsoil is brown gravelly loam about 13 inches thick, and the lower part is pale brown and light yellowish brown very cobbly loam about 17 inches thick. The substratum is very pale brown very stony loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan loam, 25 to 40 percent slopes-on convex, south- and west-facing slopes
- Raisio shaly loam, 20 to 40 percent slopes-on convex, south- and west-facing upper foot slopes
- Scoap gravelly sandy loam, 5 to 20 percent slopes-on foot slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing slopes

The included areas make up about 15 percent of the total acreage.

The permeability of this Scoap soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Scoap soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedling.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, prairie junegrass, lupine, and mallow ninebark. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIe, nonirrigated.

205-Scoap gravelly loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and colluvium, with an admixture of volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 2 inches thick. The surface layer is dark gray and grayish brown gravelly loam about 13 inches thick. The upper part of the subsoil is brown gravelly loam about 13 inches thick, and the lower part is pale brown and light yellowish brown very cobbly loam about 17 inches thick. The substratum is very pale brown very stony loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Donavan loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex, south- and west-facing upper side slopes
- Scoap gravelly sandy loam, 20 to 40 percent slopes-on side slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on concave, south- and west-facing slopes

The included areas make up about 20 percent of the total acreage.

The permeability of this Scoap soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Scoap soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 65 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 76 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, prairie junegrass, lupine, and mallow ninebark. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, watering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

206-Scoap-Rock outcrop complex, 30 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,500 to 3,000 feet. The average annual precipitation is about 20 inches, and the average annual air temperature is about 44° F. The frost-free season ranges fro ˉn 90 to 110 days. This complex is about 65 percent Scoap gravelly loam, 30 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Donavan loam, 40 to 65 percent slopes-on convex, south- and west-facing slopes
- Raisio shaly loam, 40 to 65 percent slopes-on convex, south- and west-facing upper side slopes
- Stevens channery silt loam, 40 to 65 percent slopes-on concave, south- and west-facing slopes
- very stony and very shallow soils near Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Scoap soil is very deep and well drained. It formed in glacial till and colluvium, with an admixture of volcanic ash and loess. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 2 inches thick. The surface layer is dark gray and grayish brown gravelly loam about 13 inches thick. The upper part of the subsoil is brown gravelly loam about 13 inches thick, and the lower part is pale brown and light yellowish brown very cobbly loam about 17 inches thick. The substratum is very pale brown very stony loam to a depth of 60 inches or more.

The permeability of this Scoap soil is moderate, and the available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed shale or slate. Most areas are very steep.

These soils are suited to the production of Douglas-fir. They are also suited to ponderosa pine and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 109 on the Scoap soil. The basal area is about 55 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 57 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 66 cubic feet per acre per year.

The main limitations of these soils for the harvesting of timber are steepness of slope and Rock outcrop. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, ponderosa pine, or western larch seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, pinegrass, prairie junegrass, lupine, and mallow ninebark. Overgrazing causes desirable plants, such as bluebunch wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be carefully considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

207-Scrabblers very fine sandy loam, 0 to 20 percent slopes. This very deep, well drained soil is on terraces. It formed in sandy glacial outwash material derived mainly from granitic rock and is mantled with loess and volcanic ash. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 1/2 inch thick. The upper part of the subsoil is pale brown very fine sandy loam about 6 inches thick, and the lower part is light yellowish brown fine sandy loam and very pale brown sandy loam about 13 inches thick. The substratum is very pale brown and pale yellow gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Martella silt loam, 5 to 15 percent slopes-on similar landscape positions
- Merkel stony sandy loam, 0 to 40 percent slopes-on upper terraces of toe slopes and foot slopes
- Newbell silt loam, 0 to 25 percent slopes-above the terraces on toe slopes
- Scrabblers very fine sandy loam, 30 to 65 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Scrabblers soil is moderately rapid through the subsoil and rapid through the substratum. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of ponderosa pine. It is also suited to Douglas-fir, western larch, lodgepole pine, and grand fir.

Based on a 100-year site curve, the mean site index for ponderosa pine is 110 on the Scrabblers soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 77 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, western larch, and lodgepole pin takes place naturally where seed trees are present If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Kentucky bluegrass, slender hairgrass, strawberry, and spirea. Overgrazing causes desirable plants, such as pinegrass and Kentucky bluegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to maintain good tilth, conserve moisture, and control erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are steepness of slope and rapid permeability in the substratum. Absorption lines should be installed on the contour. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIe, nonirrigated.

208-Scrabblers very fine sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in sandy glacial outwash material derived mainly from granitic rock and is mantled with loess and volcanic ash. Surfaces are planar. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The upper part of the subsoil is pale brown very fine sandy loam about 6 inches thick, and the lower part is light yellowish brown fine sandy loam and very pale brown sandy loam about 13 inches thick. The substratum is very pale brown and pale yellow gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Martella silt loam, 25 to 40 percent slopes, and Merkel stony sandy loam, 40 to 65 percent slopes-on similar landscape positions
- Newbell silt loam, 40 to 65 percent slopes-on side slopes above terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Scrabblers soil is moderately rapid through the subsoil and rapid through the substratum. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is well suited to the production of ponderosa pine. Douglas-fir, western larch, lodgepole pine, and grand fir also grow on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 110 on the Scrabblers soil. The basal area is about 63 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 67 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 67 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, western larch, and lodgepole pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of ponderosa pine, Douglas-fir, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Kentucky bluegrass, slender hairgrass, strawberry, and spirea. Overgrazing causes desirable plants, such as pinegrass and Kentucky bluegrass, to decrease and less desirable plants to increase. The location of salt licks, watering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

209-Skanid loam, 0 to 25 percent slopes. This shallow, well drained soil is on toe slopes and ridgetops of mountains. The aspect is mainly to the south and west. This soil formed in residuum derived from granite, with an admixture of volcanic ash and loess. Slopes are convex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 4 inches thick. The underlying material is pale brown, very gravelly coarse sandy loam about 5 inches thick. Below that is weathered granite at a depth of 15 inches. Depth to weathered bedrock ranges from 10 to 20 inches.

Included with this soil in mapping are areas of-

- Dragoon silt loam, 25 to 45 percent slopes-on complex, north- and east-facing foot slopes
- Moscow silt loam, 0 to 25 percent slopes-on convex, north- and east-facing toe slopes
- Raisio shaly loam, 0 to 20 percent slopes-on convex, south- and west-facing toe slopes
- Spokane loam, 0 to 25 percent slopes-on convex, south- and west-facing upper toe slopes
- soils similar to Cedonia silt loam, 5 to 15 percent slopes, Marble loamy sand, 5 to 25 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on the lower parts of toe slopes
- Rock outcrop on knobs and ridges

The included areas make up about 15 percent of the total acreage.

The permeability of this Skanid soil is moderate, and the available water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 82 on the Skanid soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Trees are occasionally subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly

pinegrass, Idaho fescue, bluebunch wheatgrass, common yarrow, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope sand the shallow depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitation for septic tank absorption fields is the shallow depth to rock. Special design is needed because of the limited depth of soil over the bedrock. The steepness of slope is a concern in installing septic tank absorption fields.

This soil is in capability subclass VIe, nonirrigated.

210-Skanid loam, 25 to 40 percent slopes. This shallow, well drained soil is on foot slopes of mountains. It formed in residuum derived from granite, with an admixture of volcanic ash and loess. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 4 inches thick. The underlying material is pale brown, very gravelly coarse sandy loam about 5 inches thick. Below that is weathered granite at a depth of about 15 inches. Depth to weathered bedrock ranges from 10 to 20 inches.

Included with this soil in mapping are areas of-

- Dragoon silt loam, 0 to 25 percent slopes-on complex, north- and east-facing toe slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Raisio shaly loam, 25 to 40 percent slopes, and Spokane loam, 25 to 40 percent slopes-on convex, south- and west-facing foot slopes
- Cedonia silt loam, 15 to 30 percent slopes, Marble loamy sand, 5 to 25 percent slopes, and Spens stony loamy sand, 25 to 45 percent slopes-on the lower parts of foot slopes
- Rock outcrop on knobs and ridges

The included areas make up about 15 percent of the total acreage.

The permeability of this Skanid soil is moderate, and the available water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 82 on the Skanid soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Trees are occasionally subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, common yarrow, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the shallow depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

211-Skanid loam, 40 to 65 percent slopes. This shallow, well drained soil is on side slopes of mountains. It formed in residuum derived from granite, with an admixture of volcanic ash and loess. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, forbs, grasses, and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 24 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the upper part of the surface layer is grayish brown loam about 6 inches thick, and the lower part is brown gravelly loam about 4 inches thick. The underlying material is pale brown, very gravelly coarse sandy loam about 5 inches thick. Below that is weathered granite at a depth of about 15 inches. Depth to weathered bedrock ranges from 10 to 20 inches.

Included with this soil in mapping are areas of-

- Dragoon silt loam, 25 to 45 percent slopes-on complex, north- and east-facing lower foot slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Raisio shaly loam, 40 to 65 percent slopes, and Spokane loam, 40 to 65 percent slopes-on convex, south- and west-facing side slopes
- Cedonia silt loam, 30 to 65 percent slopes, and Spens extremely gravelly loamy sand-on the lower parts of side slopes
- Rock outcrop on knobs and ridges

The included areas make up about 20 percent of the total acreage.

The permeability of this Skanid soil is moderate, and the available water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. It is also suited to Douglas-fir and western larch.

Based on a 100-year site curve, the mean site index for ponderosa pine is 82 on the Skanid soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine, Douglas-fir, and western larch takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival. Trees are occasionally subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of ponderosa pine or Douglas-fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, bluebunch wheatgrass, common yarrow, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

212-Smackout loam, 0 to 5 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till derived mainly from shaly rock and is mantled with volcanic ash and loess. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter 1 1/2 inches thick. The upper part of the subsoil is light yellowish brown loam about 12 inches thick, and the lower part is light brownish gray and gray gravelly loam, gravelly silty clay loam, and gravelly sandy clay loam about 36 inches thick. The substratum is gray gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Ahren loam, 2 to 20 percent slopes, and Smack out silt loam, 5 to 20 percent slopes-on similar landscape positions
- Waits loam, 0 to 15 percent slopes, and Aits loam, 0 to 15 percent slopes-on complex, north and east-facing toe slopes
- Leadpoint silt loam, 0 to 25 percent slopes-on convex, north- and east-facing toe slopes
- Martella silt loam, 0 to 5 percent slopes-on lakebed terraces
- poorly drained soils in depressions
- Rock outcrop on knobs

The included areas make up about 15 percent of the total acreage.

The permeability of this Smack out soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to grand fir, western white pine, western red cedar, western hemlock, and western larch, lodgepole pine, and Engelmann spruce.

Based on a 100-year site curve, the mean Site index for Douglas-fir is 92 on the Smack out soil. The basal area is about 51 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 45 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, western white pine, and grand fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western white pine, or grand fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, pachystima, thimbleberry, and dwarf huckleberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass s the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to maintain good tilth, conserve moisture, and control erosion. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa-grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is suited to homesite development. The main limitation is the shrink-swell potential. If buildings are constructed on this soil, proper design of foundations and footings and diverting runoff away from buildings help to prevent structural damage caused by shrinking and swelling. The main limitation for septic tank absorption fields is the moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIIc, nonirrigated.

213-Smackout loam, 5 to 20 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till derived mainly from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter 1 1/2 inches thick. The upper part of the subsoil is light yellowish brown loam about 12 inches thick, and the lower part is light brownish gray and gray gravelly loam, gravelly silty clay loam, and gravelly sandy clay loam about 36 inches thick. The substratum is gray gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Ahren loam, 2 to 20 percent slopes, Smackout silt loam, 0 to 5 percent slopes, and Waits loam, 0 to 15 percent slopes-on similar landscape positions
- Aits loam, 0 to 15 percent slopes-on complex, north- and east-facing toe slopes
- Leadpoint silt loam, 0 to 25 percent slopes-on convex, north- and east-facing toe slopes
- Martella silt loam, 5 to 15 percent slopes, and Hagen sandy loam, 0 to 15 percent slopes-on lakebed and outwash terraces
- poorly drained soils in depressions
- Rock outcrop on knobs

The included areas make up about 20 percent of the total acreage.

The permeability of this Smackout soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to grand fir, western white pine, western redcedar, western hemlock, western larch, lodgepole pine, and Engelmann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 92 on the Smackout soil. The basal area is about 51 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 45 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gulling. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, western white pine, and grand fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western white pine, or grand fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, pachystima, thimbleberry, and dwarf huckleberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, and fall chiseling help to control sheet and rill erosion. Leaving sufficient amounts of crop residue on the surface during critical erosion periods helps to maintain good tilth, conserve moisture, and control erosion. Divided slope arming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitations are the shrink-swell potential and steepness of slope. If buildings are constructed on this soil, proper design of foundations and footings and diverting runoff away from the buildings help to prevent structural damage caused by shrinking and swelling. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability. The steepness of slope is a concern in installing septic tank absorption fields.

This soil is in capability subclass IIIe, nonirrigated.

214-Smackout loam, 20 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till derived mainly from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter 1 1/2 inches thick. The upper part of the subsoil is light yellowish brown loam about 12 inches thick, and the lower part is light brownish gray and gray gravelly loam, gravelly silty clay loam, and gravelly sandy clay loam about 36 inches thick. The substratum is gray gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Ahren loam, 20 to 40 percent slopes, Smackout silt loam, 5 to 20 percent slopes, and Waits loam, 25 to 40 percent slopes-on similar landscape positions
- Aits loam, 25 to 40 percent slopes-on complex, north- and east-facing foot slopes
- Leadpoint silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Martella silt loam, 25 to 40 percent slopes, and Hagen sandy loam, 15 to 40 percent slopes-on lakebed and outwash terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Smackout soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of Douglas-fir. It is also suited to grand fir, western white pine, western redcedar, western hemlock, western larch, lodgepole pine, and Engelmann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 92 on the Smackout soil. The basal area is about 51 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 45 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, western white pine, and grand fir takes places naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled can delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western white pine, or grand fir seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, pachystima, thimbleberry, and dwarf huckleberry. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the shrink-swell potential. Special design of buildings is needed to overcome the limitation imposed by slope. If buildings are constructed on this soil, the proper design of foundations and footings and diverting runoff away from buildings help to prevent structural damage caused by shrinking and swelling. The main limitations for septic tank absorption fields are steepness of slope and moderately slow permeability. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass VIe, nonirrigated.

215-Smackout loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till derived mainly from shaly rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average, annual precipitation is about 27 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter 1 1/2 inches thick. The upper part of the subsoil is light yellowish brown loam about 12 inches thick, and the lower part is light brownish gray and gray gravelly loam, gravelly silty clay loam, and gravelly sandy clay loam about 36 inches thick. The substratum is gray gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Ahren loam, 40 to 65 percent slopes, and Waits loam, 40 to 65 percent slopes-on complex, north- and east-facing side slopes
- Leadpoint silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Smackout silt loam, 20 to 40 percent slopes-on complex foot slopes
- Martella silt loam, 25 to 40 percent slopes, and Hagen sandy loam, 15 to 40 percent slopes-on lakebed and outwash terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Smackout soil is moderately slow, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is suited to the production of Douglas-fir. It is also suited to grand fir, western white pine, western redcedar, western hemlock, western larch, lodgepole pine, and Englemann spruce.

Based on a 100-year site curve, the mean site index for Douglas-fir is 92 on the Smackout soil. The basal area is about 51 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 38 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 45 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, western white pine, and grand fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western white pine, or grand fir seedlings.

In most areas of this soil the understory vegetation is mainly pinegrass, pachystima, thimbleberry, and dwarf huckleberry.

This soil is in capability subclass VIIe, nonirrigated.

216-Spens extremely gravelly loamy sand, 30 to 65 percent slopes. This very deep, somewhat excessively drained soil is on terrace escarpments. It formed in mixed glacial outwash and colluvium. Surfaces are planar. The native vegetation is grasses forbs, and conifers. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is grayish brown extremely gravelly loamy sand about 7 inches thick. The underlying material is brown extremely gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on terraces
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Hardesty silt loam-in depressions
- Cedonia silt loam, 30 to 65 percent slopes-on terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Spens soil is very rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on this Spens soil. The basal area is about 25 percent of normal, even-aged, unmanaged stands. Thus, the mean annual Increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 22 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 26 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suitable for grazing and browsing. The native understory vegetation is mainly bluebunch wheatgrass, red threeawn, needleandthread, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIs, nonirrigated.

217-Spens stony loamy sand, 25 to 45 percent slopes. This very deep, somewhat excessively drained soil is on terrace escarpments. It formed in mixed glacial outwash and colluvium. Surfaces are planar. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,100 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface layer is grayish brown stony loamy sand about 7 inches thick. The underlying material is brown extremely gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, and Springdale cobbly sandy loam, 0 to 15 percent slopes-on terraces
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Hardesty silt loam-in depressions
- Cedonia silt loam, 30 to 65 percent slopes-on terrace escarpments

The included areas make up about 20 percent of the total acreage.

The permeability of this Spens soil is very rapid, and the available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 100 on the Spens soil. The basal area is about 25 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 22 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 26 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present.

However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, red threeawn, needleandthread, and lupine. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. In addition, cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are very rapid permeability and steepness of slope. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIIs, nonirrigated.

218-Spokane loam, 0 to 25 percent slopes. This moderately deep, well drained soil is on toe slopes and ridgetops of mountains. It formed in material weathered from granite, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the mean annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 15 to 25 percent slopes, and Donavan loam, 8 to 25 percent slopes-on complex, lower foot slopes
- Hardesty silt loam, 0 to 5 percent slopes-on concave parts of toe slopes
- Moscow silt loam, 0 to 25 percent slopes-on convex, north- and east-facing foot slopes
- soils similar to Cedonia silt loam, 5 to 15 percent slopes, Marble loamy sand, 5 to 25 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on outwash and lakebed terraces
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, oats, barley, alfalfa, and grass are the low available water capacity and the hazard of water erosion. Minimum tillage, early fall seeding, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitation for septic tank absorption fields is the depth to rock. Special design is needed because of the limited depth of soil over the bedrock. The steepness of slope also is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This soil is in capability subclass IVe, nonirrigated.

219-Spokane loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on foot slopes of mountains. It formed in material weathered from granite, with an admixture of loess and volcanic ash The aspect is to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the mean annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on complex foot slopes
- Hardesty silt loam, 0 to 5 percent slopes-at the base of foot slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Skanid loam, 25 to 40 percent slopes-on convex knobs, ridges, and ridgetops
- Cedonia silt loam, 15 to 30 percent slopes, Marble loamy sand, 5 to 25 percent slopes, and Springdale gravelly sandy loam, 0 to 15 percent slopes-on outwash and lakebed terraces
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 45 percent of normal, even-acted, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass Vle, nonirrigated.

220-Spokane loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in material weathered from granite, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the mean annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill silt loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on complex foot slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Skanid loam, 40 to 65 percent slopes-on convex knobs, ridges, and ridgetops
- Cedonia silt loam, 30 to 65 percent slopes, and Spens extremely gravelly loamy sand, 30 to 65 percent slopes-on outwash and lakebed terraces
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur where the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, arid other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also car! be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwaterinq facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

221-Spokane stony loam, 0 to 40 percent slopes. This moderately deep, well drained soil is on toe slopes, foot slopes, and ridgetops of mountains. It formed in material weathered from granite, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill very stony loam, 0 to 40 percent slopes, and Donavan stony loam, 0 to 30 percent slopes-on toe slopes and foot slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Skanid loam, 25 to 40 percent slopes-on convex, south- and west-facing knobs, ridges, and ridgetops
- Cedonia silt loam, 15 to 25 percent slopes, and Spens stony loamy sand, 25 to 45 percent slopes-on outwash and lakebed terraces
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on

this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitations are steepness of slope and the moderate depth to bedrock. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the depth to rock and steepness of slope. Special design is needed because of the limited depth of soil over the bedrock.

This soil is in capability subclass VIe, nonirrigated.

222-Spokane stony loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on side slopes of mountains. It formed in material weathered from granite, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are areas of-

- Bernhill very stony loam, 40 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes-on convex side slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Skanid loam, 40 to 65 percent slopes-on convex, south- and west-facing knobs, ridges, and ridgetops
- Cedonia silt loam, 30 to 65 percent slopes, and Spens stony loamy sand, 25 to 40 percent slopes-on outwash and lakebed terraces
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 45 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 34 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. In skidding operations, the steep slopes restrict the use of equipment with wheels or tracks. Cable yarding systems generally are safer to use and cause less displacement of the soil.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

223-Spokane-Rock outcrop complex, 0 to 40 percent slopes. The soils in this complex are on toe slopes, foot slopes, and ridgetops of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F The frost-free season is 110 to 130 days. This complex consists of about 65 percent Spokane stony loam, 0 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Bernhill very stony silt loam, 0 to 40 percent slopes, and Donavan stony loam, 0 to ,30 percent slopes-on convex toe slopes and fool: slopes
- Moscow silt loam, 25 to 40 percent slopes-on convex, north- and east-facing foot slopes
- Skanid loam, 25 to 40 percent slopes-on convex, south- and west-facing knobs, ridges, and ridgetops
- Cedonia silt loam, 15 to 25 percent slopes, and Spens stony loamy sand, 25 to 40 percent slopes-on outwash and lakebed terraces
- very shallow and very stony soils near Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Spokane soil is moderately deep and well drained. It formed in material weathered from granite, with an admixture of loess and volcanic ash. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

The permeability of the Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed granite. Most areas are moderately steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 36 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 27 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 32 cubic feet per acre per year.

Using standard equipment with wheels or tracks on these soils causes rutting and compaction when the soils are moist. Puddling can occur when the soils are wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operation.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope, the moderate depth to bedrock, and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by bedrock. The main limitations for septic tank absorption fields are the depth to rock, steepness of slope, and Rock outcrop. Special design is needed because of the limited depth of soil over the bedrock. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

224-Spokane-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of mountains. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 110 to 130 days. This complex consists of about 65 percent Spokane stony loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Bernhill very stony loam, 40 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes-on convex side slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Skanid loam, 40 to 65 percent slopes-on convex, south- and west-facing knobs, ridges, and ridgetops
- Cedonia silt loam, 30 to 65 percent slopes, and Spens stony loamy sand, 25 to 40 percent slopes-on outwash and lakebed terrace escarpments
- very shallow and very stony soils near Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Spokane soil is moderately deep and well drained. It formed in material weathered from granite, with an admixture of loess and volcanic ash. Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 inch thick The surface layer is grayish brown stony loam about 9 inches thick. The subsoil is pale brown gravelly sandy loam about 7 inches thick. The substratum is very pale brown gravelly sandy loam about 10 inches thick. Below that is weathered granite at a depth of about 26 inches. Depth to weathered bedrock ranges from 20 to 40 inches.

The permeability of the Spokane soil is moderately rapid, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed granite. Most areas are very steep.

The soils in this complex are used for grazeable woodland.

These soils are suited to the production of ponderosa pine. Douglas-fir also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is 92 on the Spokane soil. The basal area is about 36 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 27 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 32 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. The high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival. Areas also can be reforested by the planting of ponderosa pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly beardless wheatgrass, pinegrass, snowbrush ceanothus, redstem ceanothus, and common yarrow. Overgrazing causes desirable plants, such as beardless wheatgrass and pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The soils in this complex are in capability subclass VIIs, nonirrigated.

225-Springdale sandy loam, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in glacial outwash, with an admixture of loess and volcanic ash. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,300 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1 /2 inch thick. The surface layer is grayish brown sandy loam about 4 inches thick. The upper part of the underlying material is pale brown gravelly sandy loam about 7 inches thick, and the lower part is light yellowish brown very gravelly loamy coarse sand about 10 inches thick. Below that is multicolored, extremely cobbly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Garrison loam, 5 to 15 percent slopes, Springdale gravelly sandy loam, 0 to 15 percent slopes, and Springdale cobbly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Hardesty silt loam, 0 to 5 percent slopes-in depressions and at the base of toe slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Spens stony sandy loam, 25 to 45 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Springdale soil is moderately rapid to the layer of extremely cobbly coarse sand and very rapid through it. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is high.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil, but it is limited in extent.

Based on a 100-year site curve, the mean site index for ponderosa pine is 88 on the Spokane soil. The basal area is about 49 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying, Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. in most areas, the native understory vegetation is mainly bluebunch wheatgrass, needleandthread, red threeawn, and eriogonum. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. Rapid permeability is a limitation for ponds. Areas should be seeded late in fall or early in spring. In some areas, adapted grasses and legumes can be seeded with a drill.

Minimum tillage of this soil and early seeding at right angles to the erosive winds can control wind erosion on nonirrigated cropland. Leaving sufficient amounts of crop residue on the surface helps to conserve moisture and control wind erosion. Grass, legumes, or grass and legumes in rotation also provide excellent wind erosion control. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain for 2 years followed by alfalfa and grass for 4 to 8 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. The main limitations are the hazard of wind erosion and low available water capacity. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitations are large stones and steepness of slope. Cobbles and stones can hinder excavations. In addition, cutbanks are not stable and are subject to caving. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitations for septic tank absorption fields are very rapid permeability in the substratum and large stones. The contamination of ground water supplies as a result of seepage is a possibility. Large stones can interfere with the placement of absorption lines.

This soil is in capability subclass IVe, nonirrigated and irrigated.

226-Springdale gravelly sandy loam, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in glacial outwash, with an admixture of loess and volcanic ash. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,400 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown gravelly sandy loam about 7 inches thick. The underlying material is light yellowish brown very gravelly loamy coarse sand about 10 inches thick. Below that is multicolored, extremely cobbly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Garrison gravelly loam, 0 to 5 percent slopes, Springdale sandy loam, 0 to 15 percent slopes, and Springdale cobbly sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Hardesty silt loam, 0 to 5 percent slopes-in depressions at the base of toe slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Spens stony sandy loam, 25 to 45 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Springdale soil is moderately rapid to the layer of extremely cobbly coarse sand and very rapid through it. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland and for nonirrigated and irrigated crops.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil, but it is limited in extent.

Based on a 100-year site curve, the mean site index for ponderosa pine is 88 on the Springdale soil. The basal area is about 47 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at

80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil, Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high soil surface temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, needleandthread, red threeawn, and eriogonum. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. The rapid permeability of moisture limits this soil for ponds. Adapted grasses and legumes can be seeded with a drill in some areas. Areas should be seeded late in fall or early in spring.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, alfalfa, and grass is low available water capacity. Minimum tillage, early fall seeding, and leaving sufficient amounts of crop residue on the surface help to maintain tilth, conserve moisture, and control sheet and rill erosion. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and legume hay. The main limitations are low available water capacity and steepness of slope. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is large stones. Cobbles and stones may hinder excavations. In addition, cutbanks are not stable and are subject to caving. Special design of buildings is needed to overcome these limitations. The main limitations for septic tank absorption fields are very rapid permeability in the substratum and large stones. The contamination of ground water supplies as a result of seepage is a possibility. Large stones may interfere with the placement of absorption lines.

This soil is in capability subclass IVe, nonirrigated and irrigated.

227-Springdale cobbly sandy loam, 0 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in glacial outwash, with an admixture of loess and volcanic ash. The native vegetation is conifers, forbs, and grasses. Elevation is 1,400 to 2,300 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 47° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a thin mat of partially decomposed organic litter about 1/2 inch thick. The surface layer is grayish brown cobbly sandy loam about 4 inches thick. The upper part of the underlying material is pale brown gravelly sandy loam about 7 inches thick, and the lower part is light yellowish brown very gravelly loamy coarse sand about 10 inches thick. Below that is multicolored, extremely cobbly coarse sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dart loamy coarse sand, 0 to 8 percent slopes, Garrison gravelly loam, 5 to 15 percent slopes, Springdale gravelly sandy loam, 0 to 15 percent slopes, and Springdale sandy loam, 0 to 15 percent slopes-on similar landscape positions
- Hardesty silt loam, 0 to 5 percent slopes-in depressions and at the base of toe slopes
- Marble loamy sand, 5 to 25 percent slopes-on dunelike terraces
- Spens stony sandy loam, 25 to 45 percent slopes-on terrace escarpments

The included areas make up about 15 percent of the total acreage.

The permeability of this Springdale soil is moderately rapid to the layer of extremely cobbly coarse sand and very rapid through it. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland.

This soil is suited to the production of ponderosa pine. Douglas-fir also grows on this soil, but it is limited in extent.

Based on a 100-year site curve, the mean site index for ponderosa pine is 88 on the Springdale soil. The basal area is about 49 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 33 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 40 cubic feet per acre per year.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by ponderosa pine takes place naturally where seed trees are present. However, the high surface soil temperatures in summer and the low available water capacity reduce the chances of seedling survival.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, needleandthread, red threeawn, and eriogonum. Overgrazing causes desirable plants, such as bluebunch wheatgrass, to decrease and less desirable plants to increase. Rapid permeability is a limitation for ponds. Adapted grasses and legumes can be seeded with a drill in some areas. Areas should be seeded late in fall or early in spring. Seeding is advisable if the condition of the grazed woodland has deteriorated, or if the soil has been disturbed by logging or fire.

This soil is poorly suited to homesite development. The main limitation is large stones. Cobbles and stones may hinder excavations. In addition, cutbanks are not stable and are subject to caving. Special design of buildings is needed to overcome the limitation imposed by slope. The main limitation for septic tank absorption fields is very rapid permeability in the substratum. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass VIs, nonirrigated.

228-Stevens silt loam, 0 to 8 percent slopes. This very deep, well drained soil is on toe slopes and ridgetops of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer of this soil is dark gray and dark grayish brown silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 0 to 5 percent slopes, Garrison gravelly loam, 0 to 5 percent slopes, and Hunters silt loam, 0 to 5 percent slopes-on terraces
- Dehart gravelly sandy loam, 5 to 25 percent slopes, and Donavan loam, 0 to 8 percent slopes-on south- and west-facing foot slopes
- Leadpoint silt loam, 0 to 25 percent slopes-on convex, upper foot slopes in places of contact with argillite
- Molcal silt loam, 0 to 8 percent slopes-on toe slopes
- Stevens silt loam, 8 to 15 percent slopes-on upper toe slopes
- Scoap gravelly loam, 5 to 20 percent slopes-on north- and east-facing slopes
- poorly drained soils in depressions
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of the soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is annual grain or a 3-year rotation of winter wheat, spring grain, and summer fallow.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is well suited to homesite development. The main limitation for septic tank absorption fields is moderate permeability. Using sandy material to backfill the trench and extending the absorption lines help to overcome the restricted permeability.

This soil is in capability subclass IIe, nonirrigated and irrigated.

229-Stevens silt loam, 8 to 15 percent slopes. This very deep, well drained soil is on toe slopes and ridgetops of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Cedonia silt loam, 5 to 15 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Garrison loam, 5 to 15 percent slopes-on terraces
- Dehart gravelly sandy loam, 5 to 25 percent slopes, and Donavan loam, 8 to 25 percent slopes-on south- and west-facing foot slopes
- Leadpoint silt loam, 5 to 15 percent slopes-on convex foot slopes
- Molcal silt loam, 8 to 15 percent slopes-on toe slopes

- Scoap gravelly loam, 5 to 20 percent slopes-on north- and east-facing slopes
- Stevens silt loam, 0 to 8 percent slopes-on gently sloping areas
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed and recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. A suitable crop rotation on this soil is annual grain for 2 to 3 years followed by alfalfa and grass for 4 to 8 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome the limitations imposed by slope and permeability. The main limitations for septic tank absorption fields are steepness of slope and permeability. Absorption lines should be installed on the contour. Using sandy material to backfill the trench and extending the absorption lines help to overcome the moderate permeability.

This soil is in capability subclass IIIe, nonirrigated and irrigated.

230-Stevens channery silt loam, 8 to 25 percent slopes. This very deep, well drained soil is on toe slopes and foot slopes of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown channery silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Stevens silt loam, 8 to 15 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 15 percent slopes, Hunters silt loam, 5 to 15 percent slopes, and Garrison loam, 5 to 15 percent slopes-on terraces
- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on south- and west-facing upper foot slopes
- Leadpoint silt loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Molcal gravelly silt loam, 0 to 25 percent slopes on toe slopes
- Scoap gravelly loam, 20 to 40 percent slopes-on north- and east-facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for rangeland and for nonirrigated and irrigated crops.

This soil is suited to rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of irrigated and nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Divided slope farming, stripcropping, terraces, and diversions, either singly or in combination, may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

Sprinkler irrigation is the best method of water application for the production of irrigated grass and alfalfa hay. Application of water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid over irrigation, erosion, and leaching of plant nutrients.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope. Absorption lines should be installed on the contour.

This soil is in capability subclass IVe, nonirrigated and irrigated.

231-Stevens channery silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown channery silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Stevens channery silt loam, 8 to 25 percent slopes-on similar landscape positions
- Cedonia silt loam, 15 to 30 percent slopes, and Hunters silt loam, 5 to 15 percent slopes-on terraces
- Dehart gravelly sandy loam, 25 to 40 percent slopes, and Donavan loam, 25 to 40 percent slopes-on south- and west-facing upper foot slopes
- Leadpoint silt loam, 25 to 40 percent slopes-on convex, upper foot slopes in places of contact with argillite
- calcareous Molcal gravelly silt loam, 25 to 40 percent slopes-on foot slopes
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 25 to 40 percent slopes-on north- and east-facing slopes
- poorly drained soils in drainageways
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for and is suited to rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIe, nonirrigated.

232-Stevens stony silt loam, 0 to 40 percent slopes. This very deep, well drained soil is on toe slopes, foot slopes, and ridgetops of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown stony silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes, Stevens channery silt loam, 25 to 40 percent slopes, and Donavan stony loam, 0 to 30 percent slopes-on similar landscape positions
- Cedonia silt loam, 5 to 25 percent slopes, and Hunters silt loam, 5 to 15 percent slopes-on terraces
- Leadpoint silt loam, 25 to 40 percent slopes-on convex, upper foot slopes
- Molcal gravelly silt loam, 25 to 40 percent slopes-on foot slopes
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 20 to 40 percent slopes-on north- and east-facing foot slopes
- Aquolls, sloping-on concave slopes
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for and is suited to rangeland. The native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass VIe, nonirrigated.

233-Stevens stony silt loam, 40 to 65 percent slopes. This very deep, well drained soil in on side slopes of foothills. It formed in mixed glacial till, with an admixture of loess and volcanic ash. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typically, the surface layer is dark gray and dark grayish brown stony silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Dehart cobbly loam, 40 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes-on convex, north- and east-facing slopes
- Leadpoint silt loam, 40 to 65 percent slopes, and Molcal gravelly loam, 40 to 65 percent slopes
- Scoap gravelly loam, 40 to 65 percent slopes-on north- and east-facing side slopes
- Stevens channery silt loam, 25 to 40 percent slopes-on foot slopes
- Aquolls, sloping,-on concave slopes
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, stock watering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is in capability subclass VIIe, nonirrigated.

234-Stevens-Rock outcrop complex, 25 to 40 percent slopes. The soils in this complex are on foot slopes of foothills. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days. This complex is about 65 percent Stevens stony silt loam, 25 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart cobbly loam, 20 to 40 percent slopes, Stevens channery silt loam, 25 to 40 percent slopes, Donavan stony loam, 0 to 30 percent slopes, Leadpoint silt loam, 25 to 40 percent slopes, and Molcal gravelly silt loam, 25 to 40 percent slopes-on similar landscape positions
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 20 to 40 percent slopes-on north- and east-facing side slopes
- Aquolls, sloping-on concave slopes

The included areas make up about 15 percent of the total acreage.

The Stevens soil is very deep and well drained. It formed in mixed glacial till and is mantled with volcanic ash and loess. Typically, the surface layer is dark gray and dark grayish brown stony silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed shale or slate. Most areas are steep.

The soils in this complex are suited to rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by Rock outcrop. The main limitations for septic tank absorption fields are steepness of slope and Rock outcrop. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

235-Stevens-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are concave. The native vegetation is grasses and forbs. Elevation is 1,700 to 3,000 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days. This complex is about 65 percent Stevens stony silt loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Dehart cobbly loam, 40 to 65 percent slopes, Stevens channery silt loam, 25 to 40 percent slopes, and Donavan stony loam, 30 to 65 percent slopes-on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes-on north- and east-facing slopes
- Leadpoint silt loam, 40 to 65 percent slopes-in places of contact with argillite
- calcareous Molcal gravelly loam, 30 to 65 percent slopes
- Republic gravelly sandy loam, 25 to 40 percent slopes-on alluvial fans
- Scoap gravelly loam, 40 to 65 percent slopes-on north- and east-facing side slopes
- Aquolls, sloping-on concave slopes

The included areas make up about 15 percent of the total acreage.

The Stevens soil is very deep and well drained. It formed in mixed glacial till and is mantled with volcanic ash and loess. Typically, the surface layer is dark gray and dark grayish brown stony silt loam about 19 inches thick. The subsoil is brown and grayish brown gravelly loam about 19 inches thick. The substratum is grayish brown gravelly loam to a depth of 60 inches or more.

The permeability of this Stevens soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed shale or slate. Most areas are steep.

The soils in this complex are used for rangeland. In most areas, the native vegetation is mainly bluebunch wheatgrass, Idaho fescue, balsamroot, and rose. Overgrazing causes desirable plants, such as bluebunch wheatgrass and Idaho fescue, to decrease and less desirable plants to increase. The location of salt licks, watering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. In most areas, seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

236-Thout-Rock outcrop complex, 8 to 40 percent slopes. The soils in this complex are on toe slopes, foot slopes, and ridgetops of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 90 to 110 days. This complex is about 65 percent Thout gravelly loam, 8 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 25 to 40 percent slopes-on north- and east-facing slopes
- Buhrig very stony loam, 25 to 40 percent slopes on convex, upper slopes and ridgetops
- Inkier gravelly silt loam, 20 to 40 percent slopes on ridges and toe slopes
- Manley silt loam, 20 to 40 percent slopes-on concave, north- and east-facing upper slopes
- Newbell stony silt loam, 0 to 40 percent slopes, and Merkel stony sandy loam, 0 to 40 percent slopes-on convex toe slopes and foot slopes
- very stony and very shallow soils on convex slopes
- poorly drained soils in concave areas and drainageways
- talus on very steep soils below Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Thout soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till, with an admixture of volcanic ash. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is grayish brown and pale brown gravelly loam about 9 inches thick. The subsoil is light yellowish brown very gravelly loam about 7 inches thick. The substratum is yellowish brown very gravelly loam about 8 inches thick. Below that is andesite at a depth of about 24 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Thout soil moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of areas of exposed andesite. Most areas are moderately steep.

The soils in this complex have poor potential for the production of ponderosa pine and for Douglas-fir, which also grows on these soils.

Based on a 100-year site curve, the mean site index for ponderosa pine is estimated to be 75 on the Thout soil. The basal area is about 39 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 19 cubic feet per acre per year. The CMAI at 45 years of trees 0.6 inch dbh and larger is 24 cubic feet per acre per year.

Using standard equipment with wheels or tracks on these soils causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Rock outcrop causes breakage of timber and hinders yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock. Roads are more costly to construct and maintain on soils that have slopes of more than 25 percent.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush and grass species that are not controlled will delay the establishment of regeneration. Rock outcrop limits the even distribution of reforestation. Seedling mortality may be high during the summer months owing to a lack of soil moisture. Areas also can be reforested by the planting of ponderosa pine and Douglas-fir seedlings.

These soils are suited to grazing and browsing. The native understory vegetation is mainly bluebunch wheatgrass, ninebark, common snowberry, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and ninebark, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope, depth to rock, and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations of building sites are limited by bedrock. The main limitations for septic tank absorption fields are steepness of slope, depth to rock, and Rock outcrop. Special design is needed because of the moderate depth of soil over the bedrock. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

237-Thout-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The aspect is mainly to the south and west. Slopes are convex. The native vegetation is shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 27 inches, and the average annual air temperature is about 43° F. The frost-free season ranges from 90 to 110 days. This complex is about 65 percent Thout gravelly loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Aits loam, 40 to 65 percent slopes, and Newbell stony silt loam-on convex, north- and east facing slopes
- Buhrig very stony loam, 40 to 65 percent slopes on upper slopes and ridgetops
- Inkier gravelly silt loam, 20 to 40 percent slopes on south- and west-facing foot slopes
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing slopes
- Merkel stony sandy loam, 0 to 40 percent slopes-on foot slopes
- Scoap gravelly loam, 20 to 40 percent slopes-on north- and east-facing foot slopes
- poorly drained soils in concave areas and drainageways
- very stony and very shallow soils below Rock outcrop
- talus on very steep slopes below Rock outcrop

The included areas make up about 15 percent of the total acreage.

The Thout soil is moderately deep and well drained. It formed in residuum, colluvium, and glacial till, with an admixture of volcanic ash (fig. 11). Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 2 inches thick. The surface layer is grayish brown and pale brown gravelly loam about 9 inches thick. The subsoil is light yellowish brown very gravelly loam about 7 inches thick. The substratum is yellowish brown very gravelly loam about 8 inches thick. Below that is andesite at a depth of about 24 inches. Depth to bedrock ranges from 20 to 40 inches.

The permeability of this Thout soil is moderate, and the available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed andesite. Most areas are very steep.

The soils in this complex have poor potential for the production of ponderosa pine and for Douglas-fir, which also grows on this soil.

Based on a 100-year site curve, the mean site index for ponderosa pine is estimated to be 75 for the Thout soil. The basal area is about 39 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 19 cubic feet per acre per year. The CMAI at 45 years of trees 0.6 inch dbh and larger is 24 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels and tracks causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. In

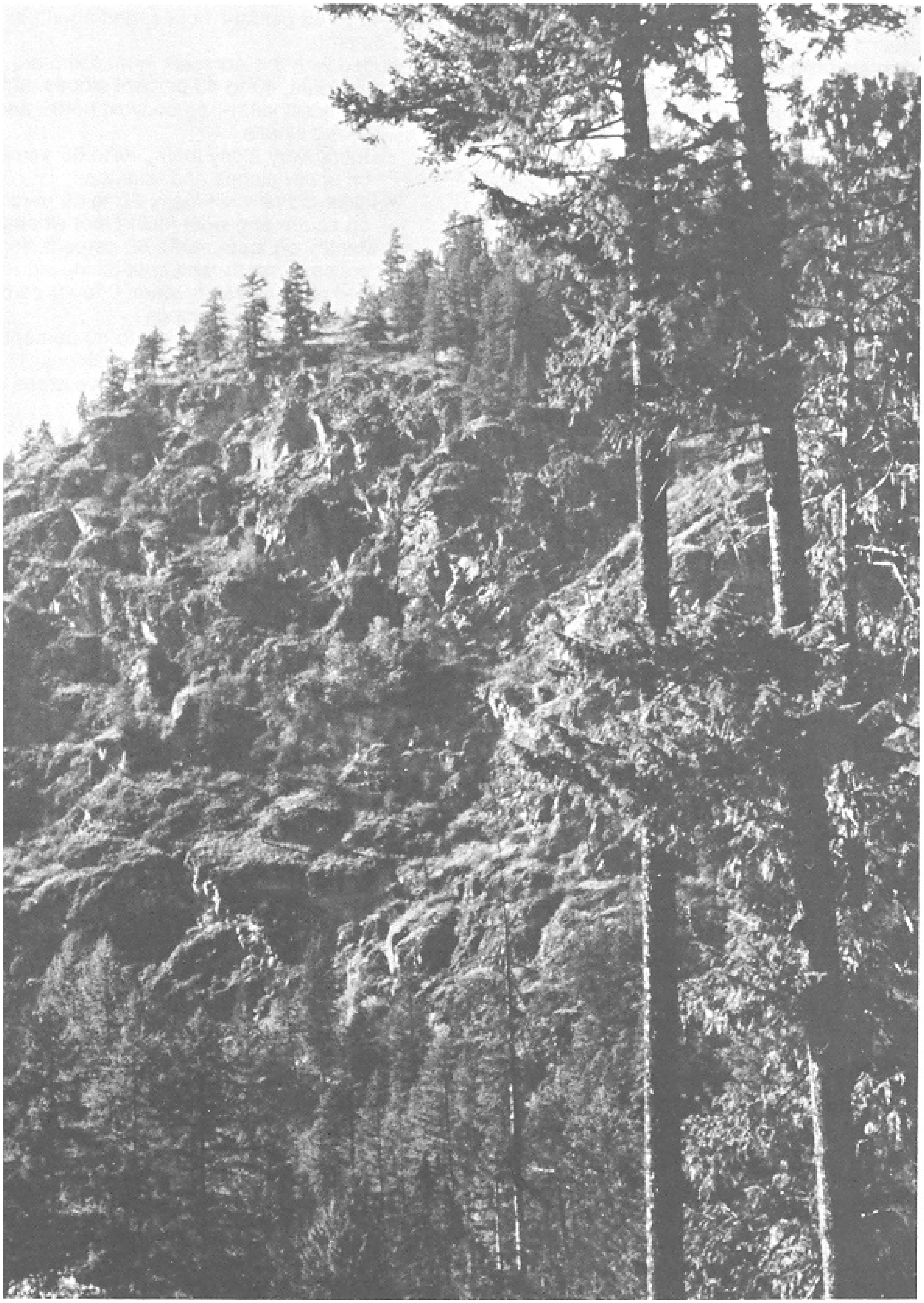

Figure 11.-Thout-Rock outcrop complex, 40 to 65 percent slopes. The Thout soil formed in colluvium. The Rock outcrop is andesite.

winter, snowpack hinders the use of equipment and limits access. Rock outcrop causes breakage of timber and hinders yarding operations.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on these steeper slopes. Large cut and fill operations remove the soil from productive use if the roads are located at mid slope. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by ponderosa pine and Douglas-fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush and grass species that are not controlled will delay the establishment of regeneration. Rock outcrop limits the even distribution of reforestation. Seedling mortality may be high during the summer months due to lack of soil moisture. Areas also can be reforested by the planting of ponderosa pine and Douglas-fir seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly bluebunch wheatgrass, ninebark, common snowberry, and common yarrow. Overgrazing causes desirable plants, such as bluebunch wheatgrass and ninebark, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads and trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage. In most areas, seeding is limited to broadcasting by hand or aerial equipment because of the steepness and roughness of the terrain.

The soils in this complex are in capability subclass Vlls, nonirrigated.

238-Vassar silt loam, 30 to 65 percent slopes. This deep, well drained soil is on side slopes of mountains. It formed in colluvium and residuum derived from granite, gneiss, or other micaceous rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,400 feet. The average annual precipitation is about 37 inches, and the mean annual air temperature is about 40° F. The frost-free season ranges from 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 3 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is brown silt loam about 9 inches thick, and the lower part is light yellowish brown and yellowish brown silt loam and loam about 21 inches thick. The substratum is light yellowish brown gravelly sandy loam about 24 inches thick. Below that is weathered granite at a depth of about 54 inches. Depth to weathered bedrock ranges from 40 to 60 inches.

Included with this soil in mapping are areas of-

- Buhrig very stony loam, 40 to 65 percent slopes on upper side slopes and ridges
- Huckleberry silt loam, 40 to 65 percent slopes on convex, north- and east-facing upper side slopes
- Martella silt loam, 25 to 40 percent slopes-on toe slopes and foot slopes along drainageways
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing slopes
- Moscow silt loam, 40 to 65 percent slopes-on south- and west-facing side slopes
- Vassar silt loam, shaly substratum, 30 to 65 percent slopes-on concave, north- and east facing slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Vassar soil is moderate, and the available water capacity is very high. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to western white pine, grand fir, western redcedar, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 118 on the Vassar soil. The basal area is about 75 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 103 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally slump when the soil is saturated.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and grand fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western white pine seedlings.

In most areas of this soil, the understory vegetation is mainly sedges, pachystima, mountain blueberry, brackenfern, and princes pine.

This soil is in capability subclass VIIe, nonirrigated.

239-Vassar silt loam, shaly substratum, 30 to 65 percent slopes. This deep, well drained soil is on side slopes of mountains. It formed in colluvium and residuum derived from micaceous rock and is mantled with volcanic ash and loess. The aspect is mainly to the north and east. Slopes are convex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,400 feet. The average annual precipitation is about 37 inches, and the average annual air temperature is about 40° F. The frost-free season ranges from 70 to 90 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 3 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The subsoil is brown, light yellowish brown, and yellowish brown silt loam and loam about 30 inches thick. The substratum is light yellowish brown gravelly sandy loam about 24 inches thick. Below that is fractured mica schist at a depth of about 54 inches. Depth to weathered bedrock ranges from 40 to 60 inches.

Included with this soil in mapping are areas of-

- Buhrig very stony loam, 40 to 65 percent slopes-on upper side slopes and ridges
- Huckleberry silt loam, 40 to 65 percent slopes-on convex, north- and east-facing upper side slopes and ridges
- Manley silt loam, 40 to 65 percent slopes-on concave, north- and east-facing slopes
- Moscow silt loam, 40 to 65 percent slopes-on convex, south- and west-facing side slopes
- Vassar silt loam, 30 to 65 percent slopes-on convex, north- and east-facing side slopes
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Vassar soil is moderate, and the available water capacity is very high. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high. Slumping occurs throughout this soil.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to western white pine, grand fir, western redcedar, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 118 on the Vassar soil. The basal area is about 75 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 90 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 103 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Cutbanks occasionally slump when the soil is saturated.

The reforestation of cutover areas by Douglas-fir, western larch, western white pine, and grand fir takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, grand fir, or western white pine seedlings.

In most areas of this soil, the understory vegetation is mainly sedges, pachystima, mountain blueberry, brackenfern, and princes pine.

This soil is in capability subclass VIIe, nonirrigated.

240-Waits loam, 0 to 15 percent slopes. This very deep, well drained soil is on toe slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 7 inches thick, and the lower part is pale brown and light brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous throughout the substratum.

Included with this soil in mapping are areas of-

- Waits loam, 15 to 25 percent slopes, Ahren loam, 2 to 20 percent slopes, and Smackout loam, 5 to 30 percent slopes-on similar landscape positions
- Bonner silt loam, 0 to 10 percent slopes-on outwash terraces
- Belzar silt loam, 5 to 25 percent slopes-on convex, north- and east-facing side slopes
- Donavan loam, 8 to 25 percent slopes-on south- and west-facing side slopes
- Martella silt loam, 5 to 15 percent slopes-on lakebed terraces
- poorly drained soils in drainageways and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 15 percent of the total acreage.

The permeability of this Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the understory vegetation is mainly pinegrass, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass is the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. Divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 to 3 years.

This soil is suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitations for septic tank absorption fields are steepness of slope and the moderate permeability. Absorption lines should be installed on the contour. Using sandy material to backfill the trench and extending the absorption lines help to overcome the restricted permeability.

This soil is in capability subclass IIIe, nonirrigated.

241-Waits loam, 15 to 25 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 7 inches thick, and the lower part is light brown and pale brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

Included with this soil in mapping are areas of-

- Waits loam, 0 to 15 percent slopes, Ahren loam, 2 to 20 percent slopes, and Smackout loam, 5 to 20 percent slopes-on similar landscape positions
- Bonner silt loam, 0 to 10 percent slopes-on outwash terraces
- Belzar silt loam, 5 to 25 percent slopes-on convex, north- and east-facing side slopes
- Donavan loam, 8 to 25 percent slopes-on south and west-facing side slopes
- Martella silt loam, 15 to 25 percent slopes-on lakebed terraces
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitations of this soil for the production of nonirrigated wheat, barley, alfalfa, and grass are steepness of slope and the hazard of water erosion. Minimum tillage, early fall seeding, fall chiseling, and leaving sufficient amounts of crop residue on the surface help to maintain good tilth, conserve moisture, and control sheet and rill erosion. In addition, divided slope farming, stripcropping, diversions, or terraces may be needed to help control erosion on nonirrigated cropland. Grassed waterways help to control water erosion caused by concentrated flow in the major draws and waterways. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slope.

This soil is in capability subclass IVe, nonirrigated.

242-Waits loam, 25 to 40 percent slopes. This very deep, well drained soil is on foot slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 7 inches thick, and the lower part is light brown and pale brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

Included with this soil in mapping are areas of-

- Waits loam, 15 to 25 percent slopes, Ahren loam, 20 to 40 percent slopes, and Smackout loam, 25 to 40 percent slopes-on similar positions
- Belzar silt loam, 25 to 40 percent slopes-on convex, north- and east-facing side slopes
- Donavan loam, 25 to 40 percent slopes-on south- and west-facing side slopes
- Martella silt loam, 25 to 40 percent slopes-on lakebed terraces
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 20 percent of the total acreage.

The permeability of this Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for grazeable woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

This soil is poorly suited to homesite development. The main limitation is steepness of slope. Special design of buildings is needed to overcome this limitation. The main limitation for septic tank absorption fields is steepness of slopes.

This soil is in capability subclass VIe, nonirrigated.

243-Waits loam, 40 to 65 percent slopes. This very deep, well drained soil is on side slopes of foothills. It formed in glacial till and is mantled with volcanic ash and loess. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 17 inches thick, and the lower part is light brown and pale brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

Included with this soil in mapping are areas of-

- Waits loam, 25 to 40 percent slopes, Ahren loam, 40 to 65 percent slopes, and Smackout loam, 40 to 65 percent slopes-on similar landscape positions
- Belzar silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Donavan loam, 40 to 65 percent slopes-on south- and west-facing side slopes
- poorly drained soils in draws and soils adjacent to seeps and springs
- Rock outcrop

The included areas make up about 25 percent of the total acreage.

The permeability of this Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This soil is used for woodland.

This soil is well suited to the production of Douglas-fir. It is also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 70 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 60 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 70 cubic feet per acre per year.

The main limitation of this soil for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

In most areas of this soil, the understory vegetation is mainly pinegrass, Saskatoon serviceberry, and kinnikinnick.

This soil is in capability subclass VIIe, nonirrigated.

244-Waits-Rock outcrop complex, 25 to 40 percent slopes. The soils in this complex are on foot slopes of foothills. The native vegetation is conifers, shrubs, forbs, and grasses. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are convex. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days. This complex is about 65 percent Waits loam, 25 to 40 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Ahren loam, 20 to 40 percent slopes, and Smackout loam, 20 to 40 percent slopes-on similar landscape positions
- Aits stony loam, 0 to 40 percent slopes, and Belzar silt loam, 25 to 40 percent slopes-on convex, north- and east-facing side slopes
- Bonner gravelly sandy loam, 30 to 65 percent slopes, and Donavan stony loam, 0 to 30 percent slopes-on south- and west-facing side slopes
- Martella silt loam, 25 to 40 percent slopes-on lakebed terraces
- very shallow and very stony soils
- poorly drained soils in draws and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Waits soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 7 inches thick, and the lower part is light brown and pale brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

The permeability of the Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed limestone or limy shale. Most areas are moderately steep and convex.

The soils in this complex are used for grazeable woodland.

These soils are well suited to the production of Douglas-fir. They are also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 48 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 56 cubic feet per acre per year.

Using standard equipment with wheels and tracks on these soils causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Using low pressure ground equipment reduces soil damage and helps to maintain productivity. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. Rock outcrop can cause breakage of timber and hinder yarding operations. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Skid trails, firebreaks, and other surface disturbances are subject to rifling and gullying. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Roads are more costly to construct and maintain on the steeper slopes. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. Rock outcrop limits the even distribution of reforestation. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

These soils are suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, serviceberry, and kinnikinnick. Overgrazing causes desirable plants, such as pinegrass, to decrease and less desirable plants to increase. The location of salt licks, stockwatering facilities, and roads or trails should be specially considered because steepness of slope may limit access by livestock. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

These soils are poorly suited to homesite development. The main limitations are steepness of slope and Rock outcrop. Special design of buildings is needed to overcome the limitation imposed by slope. Excavations for building sites are limited by Rock outcrop. The main limitations for septic tank absorption fields are steepness of slope and Rock outcrop. Rock outcrop may interfere with the placement of absorption lines.

The soils in this complex are in capability subclass VIs, nonirrigated.

245-Waits-Rock outcrop complex, 40 to 65 percent slopes. The soils in this complex are on side slopes of foothills. The native vegetation is conifers, shrubs, forbs, and grasses. The aspect is mainly to the north and east at lower elevations and to the south and west at higher elevations. Slopes are complex. Elevation is 2,100 to 4,000 feet. The average annual precipitation is about 25 inches, and the average annual air temperature is about 44° F. The frost-free season is 90 to 110 days. This complex is about 65 percent Waits loam, 40 to 65 percent slopes, and about 20 percent Rock outcrop.

Included with this complex in mapping are areas of-

- Ahren loam, 40 to 65 percent slopes, and Smackout loam, 40 to 65 percent slopes-on similar landscape positions
- Aits stony loam, 40 to 65 percent slopes, and Belzar silt loam, 40 to 65 percent slopes-on convex, north- and east-facing side slopes
- Bonner gravelly sandy loam, 30 to 65 percent slopes, and Donavan stony loam, 30 to 65 percent slopes-on south- and west-facing side slopes
- very shallow and very stony soils
- poorly drained soils in draws and soils adjacent to seeps and springs

The included areas make up about 15 percent of the total acreage.

The Waits soil is very deep and well drained. It formed in glacial till and is mantled with volcanic ash and loess. Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is light gray very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is light brown loam about 7 inches thick, and the lower part is light brown and pale brown loam about 16 inches thick. The substratum is light gray gravelly loam to a depth of 60 inches or more. The soil is calcareous in the substratum.

The permeability of this Waits soil is moderate, and the available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of areas of exposed limestone or limy shale. Most areas are very steep and convex.

The soils in this complex are used for woodland.

These soils are well suited to the production of Douglas-fir. They are also suited to ponderosa pine, western larch, western redcedar, and lodgepole pine.

Based on a 100-year site curve, the mean site index for Douglas-fir is 99 on the Waits soil. The basal area is about 56 percent of normal, even-aged, unmanaged stands. Thus, the mean increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 48 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 56 cubic feet per acre per year.

The main limitation of these soils for the harvesting of timber is steepness of slope. Using standard equipment with wheels or tracks causes rutting and compaction when the soil is moist and displacement of the surface layer when the soil is dry. Cable yarding systems are safer to use, cause less soil damage, and help to maintain productivity. Rock outcrop can cause breakage of timber and hinder yarding operations. Puddling can occur when the soil is wet, and unsurfaced roads and skid trails become sticky, slick, and almost impassable. In winter, snowpack hinders the use of equipment and limits access.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on these soils. Yarding paths, skid trails, firebreaks, and other surface disturbances are subject to rilling and gullying. Roads are more costly to construct and maintain on the steeper slopes. Large cut and fill operations remove the soil from productive use if roads are located at mid slope. Seeding the spoil from excavations reduces rill and gully erosion and sloughing. Soil compaction is increased in areas where yarding paths and skid trails are forced to converge to avoid large outcrops of rock.

The reforestation of cutover areas by Douglas-fir, western larch, lodgepole pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Areas also can be reforested by the planting of Douglas-fir, western larch, or lodgepole pine seedlings.

In most areas of these soils, the understory vegetation is mainly pinegrass and Saskatoon serviceberry.

The soils in this complex are in capability subclass VIIs, nonirrigated.

246-Wethey loamy sand. This very deep, somewhat poorly drained soil is on bottom lands, flood plains, and alluvial fans, and in depressional areas adjacent to lakes. It formed in mixed sandy alluvium. Slope is 0 to 3 percent. The native vegetation is grasses, forbs, and shrubs. Elevation is 1,500 to 2,300 feet. The average annual precipitation is about 19 inches, and the average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typically, the surface layer is mottled, grayish brown loamy sand about 28 inches thick. The underlying material is mottled, brown and light yellowish brown loamy fine sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Chamokane loam and Narcisse silt loam-on similar landscape positions
- Colville silt loam-on broad alluvial terraces
- Peone silt loam-on alluvial fans, bottom lands, and in depressions adjacent to lakes

The included areas make up about 15 percent of the total acreage.

The permeability of this Wethey soil is rapid, and the available water capacity is moderate. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 4 feet during the months of February to May. Occasional flooding occurs during these months. Runoff is slow, There is no hazard of water erosion.

This soil is used for rangeland and for nonirrigated crops.

This soil is suited to rangeland. The native vegetation is mainly tufted hairgrass, reed canarygrass, sedges, and redtop. Overgrazing causes desirable plants, such as tufted hairgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, and grass-legume hay is wetness. Wetness in spring can delay seeding of spring crops. Protective levees and proper drainage help to reduce the hazard of flooding and lower the water table. Drainage can be provided by tile or open ditches if outlets are available. Proper timing of minimum tillage helps to avoid compaction. Chiseling may be needed every few years to break up tillage pans. A suitable crop rotation on this soil is alfalfa and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitations are the hazard of flooding and wetness. Buildings should be located above the expected flood level. Drainage is needed if buildings are constructed on this soil. Cutbanks are unstable and are subject to caving. The main limitations for septic tank absorption fields are the hazard of flooding, wetness, and rapid permeability. Dikes and channels can be used to protect absorption fields from being flooded. The high water table increases the possibility of failure of septic tank absorption fields. The contamination of ground water supplies as a result of seepage is a possibility.

This soil is in capability subclass IIIw, nonirrigated.

247-Wolfeson very fine sandy loam. This very deep, somewhat poorly drained soil is in depressional areas on terraces. It formed in mixed glaciofluvial material, with an admixture of volcanic ash and loess. Slope is 0 to 3 percent. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 22 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface layer of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is white very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is brown very fine sandy loam about 15 inches thick, and the lower part is pale brown sandy loam about 8 inches thick. The upper part of the substratum is mottled, light brownish gray loam and sandy loam about 30 inches thick. The lower part is light brownish gray loamy fine sand to a depth of 60 inches or more. It is stratified with silty clay loam.

Included with this soil in mapping are areas of-

- Bridgeson silt loam-on broad alluvial terraces
- Clayton fine sandy loam, 0 to 5 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, Laketon silt loam, 0 to 5 percent slopes, and Phoebe sandy loam, 0 to 5 percent slopes-on planar terraces
- Wethey loamy sand-on alluvial fans and narrow bottom lands and in depressions adjacent to lakes

The included areas make up about 20 percent of the total acreage.

The permeability of this Wolfeson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 2 to 3 feet during the months of February to May. Runoff is very slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland and for nonirrigated crops.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, western white pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 98 on the Wolfeson soil. The basal area is about 52 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inch in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch dbh and larger is 51 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Roads may need ballast for year-round use.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, western larch, western white pine, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. Trees occasionally are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of Douglas-fir, lodgepole pine, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, Idaho fescue, Oregon-grape, and rose. Overgrazing causes desirable plants, such as pinegrass and Idaho fescue, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in overgrazed or recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of nonirrigated wheat, barley, oats, alfalfa, and grass is the seasonal high water table. Wetness may affect the growth of alfalfa in some areas. Wetness in spring may delay the seeding of spring crops. Protective levees and proper drainage help to reduce the hazard of flooding and lower the water table. Drainage can be provided by tile or open ditches if outlets are available. Proper timing of minimum tillage helps to avoid compaction. Chiseling may be needed every few years to break up tillage pans. A suitable crop rotation on this soil is grass, legumes, or grass and legumes for 4 to 8 years followed by grain for 2 or 3 years.

This soil is poorly suited to homesite development. The main limitation is wetness. Drainage is needed if buildings are constructed on this soil. Cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are wetness and moderately slow permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for the restricted permeability.

This soil is in capability subclass IIIw, nonirrigated.

248-Wolfeson very fine sandy loam, wet. This very deep, wet Wolfeson soil is in depressional areas on terraces. It formed in mixed glaciofluvial material, with an admixture of volcanic ash and loess. Slope is 0 to 3 percent. The native vegetation is conifers, shrubs, forbs, and grasses. Elevation is 1,700 to 2,500 feet. The average annual precipitation is about 22 inches, and the average annual air temperature is about 46° F. The frost-free season is 100 to 120 days.

Typically, the surface of this soil is covered with a mat of partially decomposed organic litter about 1 1/2 inches thick. The subsurface layer is white very fine sandy loam about 1/2 inch thick. The upper part of the subsoil is brown very fine sandy loam about 15 inches thick, and the lower part is pale brown sandy loam about 8 inches thick. The upper part of the substratum is mottled, light brownish gray loam and sandy loam about 30 inches thick. The lower part is light brownish gray loamy fine sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of-

- Bridgeson silt loam-on broad alluvial terraces
- Clayton fine sandy loam, 0 to 5 percent slopes, Hagen sandy loam, 0 to 15 percent slopes, and Laketon silt loam, 0 to 5 percent slopes-on planar terraces
- Peone silt loam and Wethey loamy sand-on alluvial fans and bottom lands and in depressional areas adjacent to lakes

The included areas make up about 20 percent of the total acreage.

The permeability of this Wolfeson soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 2 feet during the months of February to May. Runoff is very slow, and the hazard of water erosion is slight.

This soil is used for grazeable woodland, pasture, and hayland.

This soil is suited to the production of Douglas-fir. It is also suited to ponderosa pine, lodgepole pine, western white pine, and western larch.

Based on a 100-year site curve, the mean site index for Douglas-fir is 98 on the Wolfeson soil. The basal area is about 52 percent of normal, even-aged, unmanaged stands. Thus, the mean annual increment at 80 years of age of trees 6.6 inches in diameter at breast height (dbh) and larger is 44 cubic feet per acre per year. The CMAI at 40 years of trees 0.6 inch and larger is 51 cubic feet per acre per year.

Using standard equipment with wheels or tracks on this soil causes rutting and compaction when the soil is moist. Puddling can occur when the soil is wet. Using low pressure ground equipment reduces soil damage and helps to maintain productivity.

The proper design of road drainage systems and care in the placement of culverts help to control erosion on this soil. Roads may need ballast for year-round use.

The reforestation of cutover areas by Douglas-fir, lodgepole pine, western larch, and ponderosa pine takes place naturally where seed trees are present. If openings are made in the canopy, invading brush species that are not controlled will delay the establishment of regeneration. The seasonal high water table restricts root development. Trees commonly are subject to windthrow during periods when the soil is wet and the winds are strong. Areas also can be reforested by the planting of Douglas-fir, lodgepole pine, or western white pine seedlings.

This soil is suited to grazing and browsing. In most areas, the native understory vegetation is mainly pinegrass, tufted hairgrass, Oregon-grape, and rose. Overgrazing causes desirable plants, such as pinegrass and tufted hairgrass, to decrease and less desirable plants to increase. Adapted grasses and legumes can be seeded in recently disturbed areas to reduce erosion and provide desirable forage.

The main limitation of this soil for the production of wheat, barley, oats, clover, and grass is wetness. The soil is better suited to permanent pasture or hayland. Wetness in spring may delay the seeding of spring crops. Protective levees and proper drainage help to reduce the hazard of flooding and lower the water table. Drainage can be provided by tile or open ditches if outlets are available. The proper timing of minimum tillage helps to avoid compaction. Chiseling may be needed every few years to break up tillage pans. A suitable crop rotation on this soil is clover and grass for 4 to 8 years followed by grain for 2 years.

This soil is poorly suited to homesite development. The main limitation is wetness. Drainage is needed if buildings are constructed on this soil. Cutbanks are not stable and are subject to caving. The main limitations for septic tank absorption fields are wetness and moderately slow permeability in the substratum. The high water table increases the possibility of failure of septic tank absorption fields. Using sandy backfill for the trench and long absorption lines help to compensate for restricted permeability.

This soil is in capability subclass IVw, nonirrigated.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Ronald C. McClellan, area agronomist, Soil Conservation Service, assisted in writing this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under “Detailed soil map units.” Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the 1974 Agricultural Census, Stevens County has 971 farms that comprise 593,099 acres. Alfalfa, grass, wheat, barley, and oats are the main crops. Fruit orchards are on terraces along the Columbia River and Lake Roosevelt, and in a few upland valleys. Apples, pears, apricots, peaches, and cherries are the important fruit crops. Raspberries are grown, but the acreage is small, and production is consumed locally.

Most of the level to moderately sloping soils are well suited to the production of small grain, hay, and pasture crops. Extremely dry weather or winter injury occasionally results in the loss of perennial hay and pasture stands. The acreage of grain is normally increased for 2 to 5 years following such extremes in weather. Generally about 90,000 to 100,000 acres of cropland is used for hay and improved pasture, and about 30,000 to 35,000 acres is used for grain annually.

The soils on terraces, bottom lands, and on some uplands are suited to the production of crops and pasture. Frost may be a limitation for cultivated crops that are grown above an elevation of 3,000 feet, and occasionally frost may also damage crops in the valleys. Lack of water is often a limitation for crop production. Soil moisture is normally replenished during fall and winter. A period of moisture deficiency usually occurs during the growing season from mid-June through mid-October. The Bonner, Garrison, Cedonia, Springdale, and Clayton soils are the main soils suited to irrigated cropland.

Irrigation is practiced on soils near water sources that are sufficient to justify expenditures for irrigation equipment and other operating costs. Many of the streams and lakes have water rights claims in excess of the available water supply. These claims prevent the expansion of irrigation into associated areas. Further irrigation development is limited to ground water sources or withdrawal from Lake Roosevelt or is dependent upon development of irrigation water storage reservoirs in the upper watersheds.

The Colville River was dredged from 1904 to 1906 to improve the drainage of the associated valley soils. The river channel was further enlarged in the late 1940's and 1950's by groups of landowners. Periodic maintenance reduces flooding and improves drainage. Open drain ditches and tile drain installation are limited on these soils because of the lack of satisfactory outlets. The Colville, Chewelah, Chamokane, Bridgeson, and Saltese soils may be benefited by drainage.

Very deep, somewhat excessively drained and well drained soils that warm early in spring are well suited to many vegetables, small fruits, and orchard crops. These soils include Bisbee, Cedonia, Hunters, Koerling, and Phoebe soils. Irrigation is desirable for most specialty crops and orchards, unless wide tree spacing and mulching are practiced to conserve moisture. The latest information and suggestions for growing crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Most of the cultivated soils in Stevens County respond to applications of nitrogen, phosphate, and sulfur. Legume crops may also respond to boron fertilizer. The amount of fertilizer used on all soils should be based on soil test results, the needs of the crop to be grown, and expected yield. The Cooperative Extension Service can help to determine the kind and amount of fertilizer to apply.

Organic matter is an important source of nitrogen for crops. It also helps to increase the water intake rate, reduce surface crusting, reduce soil loss from erosion, and promote good tilth. Most of the soils in Stevens County that are used for crop production have a surface layer of silt loam, loam, sandy loam, or fine sandy loam. Many of these soils have low content of organic matter in the surface layer and generally have weak structure. Regular additions of crop residue and manure help to improve soil structure and reduce crust formation.

Soil erosion is not a serious problem, except where sloping upland soils are cultivated without applying appropriate farming practices. Erosion of the surface soil depletes the amount of available plant nutrients and organic matter. The Hodgson, Cedonia, and Bernhill soils especially need protection from erosion. Erosion of farmland may result in the loss of available water capacity and soil productivity and may cause pollution of streams by sediment and nutrients.

Erosion control practices protect the soil by providing plant cover and increasing water infiltration. A cropping system that keeps plant cover on the soil for extended periods reduces soil erosion and preserves the productive capacity of the soils. Using legume and grass forage crops in the cropping system reduces erosion on sloping land, provides nitrogen to plants, and improves tilth for the crop that follows. Minimum tillage, terraces, diversions, cross slope tillage, and cropping systems that rotate legumes and grass with grain crops help to control erosion on cropland.

Terraces and diversions reduce the length of slopes and thereby reduce runoff and erosion. These modifications of the landscape are most practical on very deep, well drained soils that have uniform, regular slopes, such as Cedonia and Koerling soils. Stripcropping and divided slope farming can be helpful in reducing runoff from long sloping fields. Cross slope tillage, especially preceding the period of fall and winter precipitation, helps to increase water infiltration and reduces runoff and erosion. Uphill plowing, that is, throwing the plow furrow up the slope, can help to conserve water and reduce soil erosion.

Soil blowing is a hazard on the sandy Bisbee soils and may be a concern on any of the sandy soils if the surface is pulverized by over-tillage. Keeping abundant plant cover or crop residue on the surface for protection against strong winds helps to retard moisture evaporation and reduce soil erosion. Roughening the soil surface through tillage can reduce soil blowing on the Clayton and Koerling soils. Information on erosion control and drainage practices for each kind of soil can be obtained at the office of the Soil Conservation Service in Colville, Washington.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 3. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of. each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 3 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (16). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclass*es* are soil groups within one class. They are designated by adding a small letter, *e, w, s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly .corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by w, s, or c because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

DeWayne J. Beck, area range conservationist, Soil Conservation Service, assisted in writing this section.

About 38 percent of Stevens County is grazed by livestock during part of the year. There are about 447,000 acres of grazeable woodland and about 154,000 acres of rangeland in Stevens County. Both beef and dairy cattle graze the native forages.

A cow-calf and cow-yearling operation is the most common system of beef production. The main areas for beef cattle production are the Kettle River Valley, the Columbia River breaks, and the Colville Valley between the towns of Kettle Falls and Valley. However, small beef operations are throughout the county.

During winter, cattle are fed and the cows have their calves, usually at the farm headquarters. Late in spring and early in summer, the cattle are turned out to graze. Summer grazing is on land owned or managed by the United States Department of Agriculture, Forest Service; Department of Natural Resources; timber companies; and the Department of the Interior, Bureau of Land Management; as well as on the land owned by private individuals. Winter feeding is from mid October through March.

Most of the rangeland is along the Columbia River breaks, on the Kelly Hill area between the Columbia and Kettle Rivers in the northeastern part of the county. Some areas of rangeland are along the Spokane River on the Spokane Indian Reservation in the southern part of the county.

Forage production in the rangeland areas depends more on annual precipitation than do the grazeable woodlands. The soils in these areas have a dark surface layer and have the potential to support bluebunch wheatgrass, big bluegrass, various forbs, and some perennial shrubs. The Bong, Cheney, Stevens, and Wethey soils are examples. Overgrazing causes cheatgrass and annual weeds to invade. If effective range management is used, however, optimum forage production and utilization can be accomplished without range deterioration.

Where moisture is more abundant in the grazeable woodlands, ponderosa pine forms a sparse to dense canopy over the bunch grasses and there are more forbs and shrubs. The soils in these areas have a light colored surface layer and have the potential to support bluebunch wheatgrass, Idaho fescue, needlegrasses, and various forbs and shrubs. The Bisbee, Donavan, Dragoon, and Spens soils are examples. In the grazeable woodlands where the average annual precipitation is 20 inches or more, a mixed coniferous forest begins and wheatgrass vegetation decreases. The soils in these areas formed in volcanic ash and have a light colored to moderately dark surface layer. They are suited to pinegrass, Kentucky bluegrass, sedge, forbs, and many shrubs. Where the tree canopy is closed, these soils produce very little forage. The Bernhill, Dearyton, Inkier, and Raisio soils are examples.

The woodland soils do not produce as much forage as the rangeland soils. After timber harvest or fire, forage production greatly increases. However, this increase is temporary because the forest canopy gradually closes. Following logging operations, skid trails, landings, and other disturbed areas are generally seeded to adapted grasses. This practice provides protection against water erosion and additional forage for grazing.

The present forage production in Stevens County is approximately one-half of the potential because the natural vegetation in many parts of the county has been greatly depleted by continuous excessive use. Seeding the rangeland and grazeable woodland that have deteriorated is advisable on most soils. If the slopes exceed 30 percent or if the soils are very stony, broadcast seeding with aerial equipment is the most effective method. For soils that have slopes of less than 30 percent and that do not have significant stones, seeding with ground equipment on a firm, well packed seedbed is the most effective method. Deferred use of the rangeland or grazeable woodland one year out of three until grass seed heads are ripe helps to maintain the forage.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 4 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 4 follows.

A range site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and timing of precipitation and the beneficial temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, the below-average and poor seasonal distribution of precipitation and nonbeneficial temperatures make growing conditions below average.

Dry Weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation-the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil-is listed by common name (8). Under *composition,* the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

woodland management and productivity

James F. McClinton, area forester, Soil Conservation Service, and Larmie D. Edwards, project forester, Washington State Department of Natural Resources, assisted in writing this section.

Eighty-four percent of Stevens County is forested. About 57 percent of the woodland is privately owned and about 43 percent is publicly owned, of which 17 percent is National Forest. The rest is owned by other Federal, State, and local government agencies (5).

The county has several large and small sawmills, one plywood plant, three post plants, one utility pole plant, and one metallurgical chip plant. Wood chips that are suited to both high and low grade paper products are shipped to paper mills outside the county and state.

Intensive woodland management has been practiced for a relatively short time in this county. Management is improving as a result of conservation programs, better marketing opportunities, and education provided by public and private foresters. No timber cutting is permitted on lands administered by the National Park Service along the Kettle and Columbia Rivers. Almost all of the private land in the county has been logged once or more. Sawmill capacity exceeds current growth rates in the county; however, by applying intensive management practices, growth rates could be increased significantly. Thinning overstocked stands can greatly increase timber yields.

Past wildfires have greatly influenced the species composition of large areas of woodland in the county. Recent wildfires have encouraged the introduction of pioneer tree species, such as western larch and lodgepole pine. These trees reproduce best in open sunlight. Woodlands are protected from fire by the Washington State Department of Natural Resources; the United States Department of Agriculture, Forest Service; and by local fire districts. The increasing population and increasing recreational activities make accidental fires a constant threat, especially during hot, dry summers.

Dwarf mistletoe (Arceuthobium spp.) is the most destructive parasite of western larch, Douglas-fir, and ponderosa pine. Laminated root rot (Phellinus weirii) is a serious disease of Douglas-fir. Red ring rot (Fomes pini) is a serious disease of western larch, lodgepole pine, and other species. Other diseases are present and may be serious in individual stands of trees.

The most serious insect problem is the larch casebearer (Coleophora laricella). This insect has reduced larch growth dramatically by defoliating the trees.

An insect control program involving the use of natural parasites has been started. The pine engraver (Ips pini), red turpentine beetle (Dendroctonus valens), mountain pine beetle (Dendroctonus ponderosae), and Douglas-fir beetle (Dendroctonus pseudotsugae) kill large numbers of trees periodically and destroy some trees annually. Large outbreaks of the pine engraver and pine beetle have been linked to stress factors, such as below normal rainfall or snowpack and poor slash treatment when pine is logged in the summertime. The Douglas-fir tussock moth (Hemerocampa pseudotsugata) occasionally builds up to large populations and can kill Douglas-fir, grand fir, subalpine fir, and western larch. Many kinds of rust, needle scale, bark insects, and defoliators are endemic to the county. Such damage varies from year to year.

The forested soils of Stevens County range from shallow to very deep, gravelly to extremely gravelly, and medium to coarse textured. Because of differences among the soils, as well as differences in climate, topography, and geology, the forests vary in composition and productivity. There are sparse stands of ponderosa pine along the Spokane and Columbia Rivers and dense stands of Douglas-fir and western larch in the northern and higher areas of the county.

The principal forest cover is the Inland Douglas-fir type. This type typically has small amounts of western larch, ponderosa pine, grand fir, and lodgepole pine. Douglas-fir is predominant. The second most predominant forest cover is the Ponderosa Pine-Western Larch-Douglas-fir type. This type is very much like the Inland Douglas-fir type, except that none of the species presently dominate the stand. The third most predominant cover is the Interior Ponderosa Pine type, which is purely pine or nearly so.

The mountainous uplands strongly influence precipitation patterns in Stevens County. The Huckleberry Mountains extend from south to north between the Colville Valley to the east and the Columbia River to the west. The Selkirk Mountains extend from south to north between the Pend Oreille County line to the east and the Colville Valley to the west. Woodland productivity generally is most extensive at mid elevations in these two mountain ranges and in the northern part of the county. North- and east-facing slopes are generally more productive than the drier south- and west-facing slopes. Western white pine was once common in the Williams Valley area in the southern part of the county, but extensive logging and land clearing activities have almost eliminated it from this area. This species is common in the northeastern part of the county.

The majority of the woodland in this county is grazed by livestock. Cattle make use of the forage produced late in spring, in summer, and early in fall. Most livestock are moved back to ranches prior to the opening of the general hunting season. Many species of wildlife use the woodland for forage and cover. The Little Pend Oreille Wildlife Recreation Area near Colville is managed to provide food for deer and other wildlife and to provide recreational activities, such as fishing, hiking, horseback riding, and camping. The Washington State Department of Game logs areas of the Little Pend Oreille Wildlife Recreation Area to provide winter feed for one of the largest white-tailed deer herds in northeastern Washington. The forested uplands are the source of most of the water that makes farming, ranching, recreation, industry, and communities possible in the Colville Valley. This water comes from winter snowpack at the higher elevations.

Soil surveys are becoming increasingly important to woodland managers as they seek ways of optimizing the productivity of forested lands. Depth, fertility, texture, and the available water capacity of a soil influence tree growth. Elevation, aspect, and climate determine which trees can be expected to thrive on a particular site, especially in mountainous areas. All of these factors are incorporated into the design and identifying features of each map unit in Stevens County. Soils vary in their ability to produce trees and in the limitations and hazards associated with harvesting them. Information concerning these limitations and hazards can be found in the section, "Detailed soil map units." Each map unit that is suited to producing wood crops contains information regarding woodland productivity, limitations for harvesting timber, concerns for producing timber, and common forest understory plants.

Woodland productivity information is based on the principal species of tree and is measured by site index and basal area. Site index is the average height, in feet, of the dominant and co-dominant trees of a given species at a specified age. Ponderosa pine and Douglas-fir were the principal species measured on most soils. Basal area is the cross-sectional area of a tree bole measured in square feet at 4 1/2 feet above ground level on the uphill side of the tree. It is usually expressed in square feet of the cross-sectional area per acre and indicates the stand density of the particular area measured (3). Basal area and site index were used to compute the mean annual increment (MAI) at age 80 and mean annual increment at culmination (CMAI) (10, 9).

In the map unit descriptions, following the site index and the average percentage of basal area for normal stands, MAI and CMAI are given in terms of cubic feet per acre per year. These measures of productivity for both ponderosa pine and Douglas-fir are based on information in United States Department of Agriculture Technical Bulletin 630, which was developed for unmanaged, fully stocked stands of ponderosa pine (11). Suitable productivity information is not available for Douglas-fir in the Stevens County area; however, Bulletin 630 will provide an adequate estimate. Quaking aspen productivity is based on United States Department of Agriculture Bulletin 1291 (4).

Table 5 summarizes the forestry information given in the detailed map unit descriptions about woodland use and can serve as a quick reference for important woodland interpretations. Map unit symbols are listed and the CMAI for each soil is given. The CMAI is adjusted for lower than normal basal areas and Rock outcrop where applicable (10, 9).

In table 5, the soils are also rated for a number of factors to be considered in management. Slight, moderate and severe are used to indicate the degree of the major soil limitations.

Equipment limitation ratings refer to the limits placed upon the use of equipment, throughout the year or seasonally, as a result of soil characteristics and climate. A rating of high indicates that equipment use is not limited to a particular kind of equipment or time of year. Moderate indicates a short seasonal limitation or a need for some modification in management or in equipment because of soil wetness, a fluctuating water table, or some other factor. Sev*ere* indicates a seasonal limitation; a need for special equipment or management, such as the use of one of the cable-yarding logging systems; or a hazard in the use of equipment.

Steepness of slope and soil wetness are the main factors that cause limitations in equipment use. As gradient and length of slope increase, the difficulty in using equipment with wheels increases. On the steeper slopes, equipment with tracks is needed. On the steepest gradients, it is not safe to operate equipment with tracks, and more sophisticated systems need to be used. Soil wetness due to heavy rainfall or snowmelt, especially in combination with fine textured soil, can severely limit the use of equipment and make harvesting practical only during dry periods.

Seedling mortality ratings refer to the probability of death of native or planted tree seedlings of the principal species in a particular map unit as influenced by the soil or topographic conditions. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted or those that naturally regenerate during a period of sufficient soil moisture. Slight indicates that no problem is expected under usual conditions; moderate indicates that some mortality can be expected and that extra precautions are advisable; and severe indicates that mortality will be high and that extra precautions are essential for successful reforestation.

Droughtiness of the surface layer, especially on south or southwest-facing slopes; soil wetness; or ridgetop locations account for seedling mortality. To offset these factors, it may be necessary to use a larger than usual planting stock, special site preparation, special harvesting techniques, or reinforcement planting.

Ratings of windthrow hazard are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of slight indicates that trees are not normally blown down by wind. Strong winds may break trees but not uproot them. Moderate indicates that an occasional tree may be blown down during periods of excessive wetness and strong winds; and severe indicates that many trees may be expected to be blown down during periods of soil wetness and moderate or strong winds. Restricted rooting depth because of a high water table, underlying bedrock, an impervious layer, or poor anchoring of roots as a result of a loose surface layer and subsoil can be responsible for windthrow or tree tipover. Moderate and severe ratings signal the need for more care in thinning the edges of woodland stands, the need for a plan for periodic salvage of windthrown trees, and the need for an adequate road and trail system to allow for salvage operations.

Plant competetion ratings refer to the likelihood that brushy plants will invade if openings are made in the tree canopy. A *slight* rating indicates that unwanted brushy plants are not likely to delay the development of natural reforestation and planted seedlings; moderate indicates that competition can be expected to delay natural or planted reforestation; and severe indicates that competition can be expected to prevent natural or planted reforestation. Favorable climate and productive soils are responsible for plant competition. Generally, the hazard of brush invasion decreases as elevation increases. In many cases, brush competition depends upon the quantity and proximity of seed sources of undesirable plants. Moderate and severe ratings indicate the need for careful and thorough post-harvest cleanup in preparation for reforestation and possibly mechanical or chemical treatment to retard the growth of brush and allow for seedlings to develop.

The potentail productivity of common trees on a soil is expressed as site index. As previously discussed, this index is determined by taking height and age measurements on selected trees within stands of a given species. The procedure and technique for taking the measurements are given in the site index tables used for Stevens County (11, 4). When adjusted by basal area, site index values can be converted into estimated yields at various ages by carefully using the appropriate yield tables. Common trees are listed in the same order as in the map units. Generally, only one or two woodland species predominate.

Trees to plant are those that are used for reforestation or, if suitable conditions exist, those that naturally regenerate. The species listed are suited to the soils and produce a commercial wood crop. Desired product; topographic position, such as on a ridgetop; and personal preference are three among many factors that can influence the choice of trees to use for reforestation.

woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 6 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 6 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest (6).

recreation

The forests, lakes, streams, and valleys offer many recreational opportunities in Stevens County. The Washington State Department of Game operates the Little Pend Oreille Wildlife and Recreational Area and provides boating access to many lakes. The Coulee Dam National Recreation Area extends along the western part of the county, where Lake Roosevelt was formed by the construction of Grand Coulee Dam. In both of these recreation areas, campgrounds and boating facilities have been developed.

Typical winter activities include both downhill and cross-country skiing along with snowmobiling and sledding. There are many developed roadways that are reserved for snowmobiles. Many of these trails are delineated on maps, which are made available by local agencies and businesses.

Spring and summer activities include hiking, camping, berrypicking, fishing, swimming, and boating. Waterskiing and fishing are popular activities on many lakes. Dispersed recreational activities are available mainly on national forest lands. Most of the land owned by forest products companies is open to the public; although, during the fire season, some areas are closed.

A major activity in the fall is the big game hunting season. Both white-tailed and mule deer are throughout the county. Upland game includes wild turkey, several species of grouse, and pheasants.

Many waterside recreational facilities operated by resorts are available. These facilities are expanding as the number of recreationists increase. There are two golf courses that attract visitors as well as local people. As the demand for more recreational opportunities increases, Stevens County is prepared to provide the clean outdoor environment and services people desire.

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. Slight means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Ivan L. Lines, general biologist, Soil Conservation Service, assisted in writing this section.

The soils of Stevens County are dominated by coniferous forests, which provide habitat for a wide variety of woodland wildlife. Numerous openings have been created in the forests by logging or clearing the land for farming. Over 100 named lakes, 315 ponds, and 125 marshes and swampy areas are interspersed throughout forests and farmlands. In addition, there are about 175 named creeks, as well as the Kettle, Columbia, Colville, Little Pend Oreille, and Little Spokane Rivers. Numerous aquatic habitats provide for the needs of several aquatic animals, as well as several semiaquatic and terrestrial animals that live between terrestrial and aquatic habitats.

Freshwater fisheries constitute an important economic and recreation resource of the county. The most sought after fish are rainbow, cutthroat, brown, brook, and lake trout; Kokanee salmon; largemouth and smallmouth bass; walleye; and catfish.

Forested, cropland, and aquatic habitats support more than 225 species of birds. About 57 species are attracted to aquatic habitats. Most birds are migratory. They spend winter in the warmer climate to the south but breed and raise their young in this area.

Many species of birds and mammals help to control insects and rodents that are injurious to crops, orchards, trees in forests, and gardens. Upland game birds include the blue, spruce, and ruffed grouse; Hungarian partridge; California quail; ring-necked pheasant; turkey, and mourning dove. Aquatic habitats support most waterfowl common to the Pacific Flyway, as well as other water-oriented birds, such as grebes, gulls, shore birds, and osprey.

The more common fur-bearing animals are the black bear, raccoon, weasel, skunk, badger, coyote, bobcat, marmot, beaver, muskrat, porcupine, and snowshoe hare. Large mammals include elk, white-tailed and mule deer, moose, bighorn sheep, and mountain goats.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legume are depth of the root zone, texture of the surface layer available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are alta fescue, timothy, alsike clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are pinegrass, bluebunch wheatgrass, balsamroot, yarrow, beargrass, and lupine.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Douglas fir, ponderosa pine, lodgepole pine, western larch, and quaking aspen.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are redosier dogwood, bitterbrush, snowberry, serviceberry, ninebark, and oceanspray.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattail, reed canarygrass, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include California quail, mourning dove, pheasant, meadowlark, cottontail, and Savannah sparrow.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include turkey, ruffed grouse, blue grouse, white-tailed deer, woodpeckers, squirrels, porcupine, and black bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include mule deer, badger, coyote, and horned lark.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided it this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface laver are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder comp-action of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill-trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair, or poor as a source of roadfill and topsoil. They are* rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs it place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles aid have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given,

engineering index properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SPSM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance (12). In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dryweight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low,* a change of less than 3 percent; *moderate,* 3 to 6 percent; and *high,* more than 6 percent. *Very high,* greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Tables 15 and 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are rot subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table-that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An

artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet in table 16. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (17). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent *(Aqu,* meaning water, plus *ent,* from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents *(Hapl,* meaning minimal horizonation, plus *aquent,* the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are net representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (15). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (17). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Ahren series

The Ahren series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in calcareous glacial till derived mainly from shaly rock and limestone and are mantled with volcanic ash and loess. Slope ranges from 2 to 65 percent. Elevation ranges from 1,800 to 3,800 feet. Average annual precipitation ranges from 22 to 32 inches, and average annual air temperature is about 44° F. The frost-free season is 90 to 110 days.

Typical pedon of Ahren loam, 2 to 20 percent slopes; 2,900 feet east and 400 feet south of the northwest corner of sec. 19, T. 39 N., R. 41 E., of the Willamette meridian:

O1-1 1/2 inches to 0; partially decomposed needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

B21ir-0 to 4 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and common coarse roots; many fine and medium and few coarse pores; 5 percent pebbles; neutral; clear wavy boundary.

B22ir-4 to 12 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium and few coarse pores; 10 percent pebbles; neutral; clear wavy boundary.

IIC1-12 to 20 inches; light brownish gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium and few coarse pores; 20 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary

IIC2-20 to 30 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; common fine and medium and few coarse roots; common fine and medium and few coarse pores; 25 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC3-30 to 40 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium and few coarse roots; common fine and medium and few coarse pores; 30 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC4-40 to 60 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and plastic; few fine, medium, and coarse roots; few fine, medium, and coarse pores; 35 percent pebbles; strong effervescence; strongly alkaline.

Mean annual soil temperature at a depth of 20 inches is 45° to 47° F. Content of fragments in the control section ranges from 15 to 35 percent by volume.

An A1 horizon, as much as 4 inches thick, is in some pedons.

The B2ir horizon has hue of 10YR or 7.5YR; value of 5 or 6, dry and 3 or 4, moist; and chroma of 3 o- 4, dry or moist. Content of rock fragments is as much as 10 percent. Reaction is neutral to mildly alkaline.

The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6, dry and 3 or 4, moist; and chroma of 1 or 2, dry or moist. It is loam, clay loam, or silty clay loam. Content of rock fragments ranges from 15 to 35 percent. Reaction is moderately alkaline or strongly alkaline.

Aits series

The Aits series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 2,000 to 5,000 feet. Average annual precipitation ranges from 22 to 35 inches, and average annual air temperature is about 43° F. The frost-free season is 90 to 110 days.

Typical pedon of Aits stony loam, 0 to 40 percent slopes; 1,460 feet east and 2,400 feet south of the northwest corner of sec. 26, T. 40 N., R. 37 E., of the Willamette meridian:

O2-1 inch to 0; partly decomposed leaves, twigs, needles, and roots.

A1-0 to 2 inches; brown (10YR 5/3) stony loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine roots; many fine pores; 5 percent stones; slightly acid; abrupt smooth boundary.

B2ir-2 to 12 inches; brown (7.5YR 5/4) stony loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, friable, nonsticky and slightly plastic; weakly smeary; many fine roots; many fine pores; 5 percent stones; slightly acid; clear wavy boundary.

IIC1-12 to 17 inches; light gray (10YR 7/2) gravelly loam, light olive brown (2.5Y 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine roots; many fine pores, 15 percent pebbles; slightly acid; gradual wavy boundary.

IIC2-17 to 34 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine roots; many fine pores; few pockets and lenses of brown (10YR 4/5) moist clay loam; 25 percent angular pebbles; neutral; gradual wavy boundary.

IIC3-34 to 45 inches; light gray (2.5Y 7/2) gravelly loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse angular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine pores; 25 percent angular pebbles; slightly acid; gradual wavy boundary.

IIC4-45 to 60 inches; pale olive (5Y 6/3) very gravelly clay loam, olive (5Y 4/3) moist; coating of light olive brown (2.5Y 5/4) moist on faces of peds moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; many clay films on faces of peds; 50 percent angular pebbles; slightly acid; gradual wavy boundary.

Mean annual soil temperature at a depth o1 20 inches ranges from 45° to 47° F. The control section has 15 to 35 percent rock fragments. Reaction is slightly acid or neutral. The mantle of volcanic ash and loess; ranges from 7 to 13 inches in thickness.

The A horizon has value of 3 through 7, dry and 3 through 5, moist and chroma of 1 through 3, try or moist.

The Bir horizon has hue of 7.5YR or 10YR; value of 4 through 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. It is silt loam, loam, or very fine sandy loam. Content of rock fragments ranges from 5 to 25 percent.

The IIC horizon has hue of 2.5Y, 5Y, or 10YR; value of 5 through 7, dry or 4 or 5, moist; and chroma of 2 through 4, moist or dry. It is silt loam, loam, or sandy loam. Below a depth of 40 inches, it is clay loam or sandy clay loam. Content of rock fragments ranges from 15 to 35 percent to a depth of 40 inches and from 15 to 60 percent below a depth of 40 inches.

Belzar series

The Belzar series consists of moderately deep, well drained soils on foot slopes and ridgetops of foothills. These soils formed in residuum and colluvial material derived from calcareous shaly rock and limestone and are mantled with volcanic ash and loess. Slope ranges from 5 to 65 percent. Elevation ranges from 3,000 to 5,500 feet. Average annual precipitation ranges from 22 to 35 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Belzar silt loam, 25 to 40 percent slopes; 300 feet east and 1,900 feet north of the southwest corner of sec. 6, T. 39 N., R. 42 E., of the Willamette meridian:

O1&O2-1 inch to 0; partially decomposed organic litter of needles, twigs, leaves, bark, and cones of mixed conifers and deciduous trees and shrubs; abrupt smooth boundary.

B21ir-0 to 8 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine, common medium, and few coarse roots; many very fine and fine pores; 5 percent channers; neutral; clear wavy boundary.

B22ir-8 to 13 inches; light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; many fine, common medium, and few coarse roots; many very fine and fine pores; 10 percent channers; neutral; clear wavy boundary.

IIC1-13 to 23 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine, few medium and coarse roots; common fine and medium pores; 30 percent channers; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2-23 to 30 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine, medium, and coarse pores; 50 percent channers, including greenish brown shaly rock with white and very pale brown precipitated lime coatings; strong effervescence; moderately alkaline; clear irregular boundary.

IIC3-30 to 38 inches; pale brown (10YR 6/3) extremely channery loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few coarse roots; 75 percent channers, including gray shaly rock with white and pale brown precipitated lime coatings; strong effervescence; moderately alkaline; clear irregular boundary.

R-38 inches; fractured gray (N 5/0) calcareous phyllite.

The depth to shale ranges from 20 to 40 inches. The mantle of volcanic ash and loess ranges from 7 to 13 inches in thickness. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. The control section averages 35 to 80 percent shaly rock fragments.

The B2 horizon has hue of 10YR through 5YR; value of 5 through 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam. Reaction is slightly acid or neutral. Content of shaly rock fragments ranges from 5 to 25 percent by volume and increases with depth.

The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 through 7, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam, loam, or silty clay loam. Content of shaly rock fragments ranges from 35 to 80 percent. Reaction is mildly alkaline or moderately alkaline.

Bernhill series

The Bernhill series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 1,800 to 3,000 feet. Average annual precipitation ranges from 18 to 25 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 105 to 125 days.

Typical pedon of Bernhill silt loam, 25 to 40 percent slopes; 600 feet west and 2,300 feet north of the southeast corner of sec. 27, T. 30 N., R. 42 E., of the Willamette meridian:

A1-0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 10 percent pebbles; neutral; abrupt smooth boundary.

A3-5 to 12 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and very fine pores; 10 percent pebbles; neutral; abrupt smooth boundary.

B21-12 to 18 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very line pores; 15 percent pebbles; thin patchy clay films on peds; neutral; clear wavy boundary.

B22-18 to 38 inches; yellowish brown (10YR 5/4) gravelly heavy loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; thin continuous clay films on peds; thin siliceous coatings on peds; 20 percent pebbles; neutral; clear wavy boundary.

C1-38 to 60 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; common medium distinct mottles, olive (5Y 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; 25 percent pebbles; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. The control section is 5 to 35 percent coarse fragments. Reaction is neutral or slightly acid.

The A horizon has value of 5 or 6, dry and 3 through 5, moist and chroma of 2 through 4, dry or moist. Content of coarse fragments ranges from 5 to 35 percent. Texture is silt loam or very stony loam.

The B2 horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or silt loam. Content of coarse fragments ranges from 15 to 35 percent.

The C horizon has value of 5 or 6, dry and 3 through 5, moist and chroma of 3 or 4, dry or moist. I: is loam or silt loam. Content of coarse fragments ranger from 15 to 35 percent.

Bestrom series

The Bestrom series consists of moderately deep, well drained soils on toe slopes and foot slopes of foothills. These soils formed in glacial till and are mantled with volcanic ash and loess. Slope ranges from 0 to 40 percent. Elevation ranges from 1,800 to 2,800 feet. Average annual precipitation ranges from 18 to 21 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 105 to 125 days.

Typical pedon of Bestrom silt loam, 0 to 15 percent slopes; 50 feet south and 2,100 feet east of the northwest corner of sec. 8, T. 29 N., R. 40 E., of the Willamette meridian:

O1-1/2 inch to 0; needles, leaves, and twigs; abrupt smooth boundary.

A1-0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; 10 percent pebbles; neutral; clear wavy boundary.

B21-6 to 11 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine pores; 25 percent pebbles; neutral; clear wavy boundary.

B22-11 to 16 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine pores; 30 percent pebbles; neutral; clear wavy boundary.

C1-16 to 24 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; 30 percent pebbles; neutral; clear wavy boundary.

C2-24 to 37 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; 30 percent pebbles; neutral.

R-37 inches; basalt.

Depth to a lithic contact is 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Content of rock fragments in the control section ranges from 15 to 35 percent. Reaction is slightly acid or neutral.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of rock fragments ranges from 5 to 15 percent.

The B horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam, silt loam, or sandy loam. Content of rock fragments ranges from 15 to 35 percent.

The C horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or sandy loam. Content of rock fragments ranges from 20 to 35 percent.

Bisbee series

The Bisbee series consists of very deep, somewhat excessively drained soils on undulating, dunelike terraces and terrace escarpments. These soils formed in wind worked, mixed sandy outwash material. Slope ranges from 0 to 45 percent. Elevation ranges from 1,400 to 2,100 feet. Average annual precipitation ranges from 17 to 20 inches, and average annual temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Bisbee loamy fine sand, 0 to 15 percent slopes; 2,400 feet east and 600 feet north of the southwest corner of sec. 30, T. 36 N., R. 38 E., of the Willamette meridian:

O1-1/2 inch to 0; undecomposed needles, twigs, and bark; abrupt smooth boundary.

A1-0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; neutral; clear smooth boundary.

C1-4 to 18 inches; light brownish gray (10YR 6/2) loamy fine sand, light olive brown (2.5Y 5/4) moist; massive; loose, nonsticky and nonplastic; common fine roots; few fine faint dark brown iron stains on sand particles; neutral; clear wavy boundary.

C2-18 to 60 inches; light yellowish brown (2.5Y 6/4) sand, olive brown (2.5Y 4/4) moist; single grain; loose; few fine roots; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 52° F. Reaction is neutral or slightly acid. Some pedons have a thin A2 horizon.

The A horizon has chroma of 2 or 3, moist or dry.

The C horizon has hue of 10YR or 2.5Y; value of 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is loamy fine sand, loamy sand, fine sand, or sand.

Bong series

The Bong series consists of very deep, somewhat excessively drained soils on terraces and terrace escarpments. These soils formed in mixed sandy glacial outwash and have an admixture of volcanic ash and loess in the surface layer. Slope ranges from 0 to 25 percent. Elevation ranges from 1,800 to 2,500 feet. Average annual precipitation ranges from 15 to 18 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 130 to 150 days.

Typical pedon of Bong sandy loam, 0 to 15 percent slopes; 2,900 feet south and 200 feet east of the northwest corner of sec. 7, T. 27 N., R. 38 E., of the Willamette meridian:

A1p-0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many roots; neutral; abrupt smooth boundary.

A12-8 to 16 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many fine roots; many fine pores; neutral; gradual wavy boundary.

B2-16 to 24 inches; yellowish brown (10YR 5/4) coarse sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common fine roots; many fine pores; neutral; clear wavy boundary.

IIC1-24 to 33 inches; brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine pores; neutral; clear wavy boundary.

IIC2-33 to 60 inches; pale brown (10YR 6/3) coarse sand, single grain; loose; few fine roots; slightly acid.

Depth to coarse sand or loamy coarse sand ranges from 18 to 30 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 52° F. Reaction is slightly acid or neutral.

The Ap or A1 horizon has chroma of 1 or 2, dry or moist.

The B2 horizon has value of 4 or 5, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is sandy loam or coarse sandy loam.

The IIC1 horizon has value of 3 or 4, moist and chroma of 3 or 4, dry or moist. The IIC2 horizon is coarse sand or loamy coarse sand. Content of pebbles can be as much as 25 percent in some pedons.

Bonner series

The Bonner series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in glacial outwash and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 1,800 to 2,500 feet. Average annual precipitation ranges from 18 to 25 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Bonner silt loam, 0 to 10 percent slopes; 660 feet south and 125 feet east of the northwest corner of sec. 27, T. 30 N., R. 41 E., of the Willamette meridian:

O1-2 to 1 inch; needles, cones, and twigs; medium acid.

O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, decomposed needles, leaves, twigs, bark, and cones; medium acid; abrupt smooth boundary.

A2-intermittent, light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; single grain; loose; many fine and medium roots; common very fine pores; slightly acid; abrupt broken boundary.

B21ir-0 to 4 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many fine and very fine roots; many fine and very fine pores; 10 percent pebbles; neutral; clear smooth boundary.

B22ir-4 to 17 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine pores; 10 percent pebbles; neutral; clear smooth boundary.

IIB3ir-17 to 25 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and very fine roots; common fine and very fine pores; 20 percent pebbles; neutral; clear wavy boundary.

IIIC1-25 to 35 inches; very pale brown (10YR 7/3) gravelly loamy sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; few fine and very fine pores; 20 percent pebbles, 10 percent cobbles; neutral; abrupt wavy boundary.

IIIC2-35 to 60 inches; very pale brown (10YR 7/3), very gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose; few fine roots; 30 percent pebbles, 10 percent cobbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Reaction is slightly acid or neutral.

Reaction of the 0 horizon ranges from slightly acid to strongly acid. The very thin layer of volcanic ash (A2 horizon) is not present in some pedons.

The B horizon has hue of 10YR or 7.5YR and value of 4 through 6, dry and 3 or 4, moist. It is silt loan, loam, or sandy loam. Content of rock fragments ranges from 5 to 35 percent.

In the IIIC horizon, content of rock fragments ranges from 20 to 50 percent.

Bossburg series

The Bossburg series consists of very deep, very poorly drained soils on bottom lands. These soils formed in alluvial volcanic ash. Slope ranges from 0 to 3 percent. Elevation ranges from 2,000 to 2,500 feet. Average annual precipitation is 18 to 25 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Bossburg muck; 1,400 feet west and 100 feet south of the northeast corner of sec. 34, T. 31 N., R. 40 E., of the Williamette meridian:

Oap-8 inches to 0; black (10YR 2/1) muck, dark gray (10YR 4/1) dry; about 12 percent fiber, less than 3 percent rubbed; moderate medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine pores; neutral; abrupt smooth boundary.

IIA1g-0 to 10 inches; very dark brown (10YR 2/2) silt loam (volcanic ash), very dark gray (10YR 3/1) dry; weak thin and medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; many medium distinct mottles of dark brown (7.5YR 4/4) moist; neutral; clear wavy boundary.

IIC1g-10 to 26 inches; dark gray (5Y 4/1) silt loam (volcanic ash), gray (5Y 6/1) dry; massive; slightly hard, firm, slightly sticky and slightly plastic; common fine roots; many fine pores; many medium distinct mottles of dark brown (7.5YR 4/4) moist; neutral; gradual wavy boundary.

IIC2g-26 to 46 inches; grayish brown (2.5Y 5/2) silt loam (volcanic ash), white (2.5Y 8/0) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; many medium distinct mottles of dark reddish brown (5YR 3/4) moist; mildly alkaline; abrupt wavy boundary.

IIIOa2-46 to 60 inches; dark grayish brown (2.5Y 4/2) rubbed sapric material, light brownish gray (2.5Y 6/2) dry; about 12 percent fiber, less than 5 percent rubbed; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; few fine pores; mildly alkaline.

Mean annual soil temperature at a depth of about 20 inches ranges from 49° to 51° F. The soils are saturated during winter and spring. The control section is more than 60 percent vitric volcanic ash. Reaction is neutral or mildly alkaline.

Organic matter content in the Oap horizon ranges from 35 to 50 percent.

The A1 horizon has value of 2 or 3, moist and 3 or 4, dry and chroma of 1 or 2, moist or dry.

The C horizon has hue of 2.5Y or 5Y; value of 6 through 8, dry and 4 or 5, moist; and chroma of 0 through 2, moist or dry. Mottles range from few fine faint to many medium distinct.

Brickel series

The Brickel series consists of moderately deep, well drained soils on upper side slopes and ridgetops of mountains. These soils formed in residuum, colluvium, and glacial till derived from granitic rock and are covered with an admixture of volcanic ash and loess. Slope ranges from 20 to 60 percent. Elevation ranges from

4,500 to 7,000 feet. Average annual precipitation ranges from 35 to 45 inches, and average annual air temperature is about 40° F. The frost-free season ranges from 60 to 80 days.

Typical pedon of Brickel stony loam, 20 to 60 percent slopes; on Calispel Peak, 500 feet north of the center of sec. 21, T. 34 N., R. 42 E., of the Williamette meridian:

A11-0 to 8 inches; dark grayish brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; many fine pores; 10 percent stones and 10 percent pebbles; slightly acid; clear wavy boundary.

A12-8 to 16 inches; dark grayish brown (10 YR 4/2) stony loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; 10 percent stones, 5 percent cobbles, and 15 percent pebbles; slightly acid; clear wavy boundary.

B2-16 to 32 inches; brown (10YR 5/3) very stony fine sandy loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; common fine pores; 20 percent stones, 10 percent cobbles, and 15 percent pebbles; slightly acid; abrupt wavy boundary.

C1-32 to 38 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; 30 percent stones, 15 percent cobbles, and 15 percent pebbles; slightly acid; abrupt wavy boundary.

R-38 inches; fractured fine grain gneiss.

Depth to fractured bedrock ranges from 2C to 40 inches. The upper part of the control section is 30 to 60 percent volcanic ash. The mollic epipedon ranges from 8 to 16 inches in thickness. Content of rock fragments in the control section ranges from 40 to 70 percent.

The A horizon has hue of 7.5YR or 10YR; value of 3 or 4, dry and 2 or 3, moist; and chroma of 1 or 2, dry or moist. Content of rock fragments ranges from 10 to 25 percent.

The B horizon has hue of 7.5YR or 10YR; value of 5 to 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. Texture is fine sandy loam or loam. Content of gravel ranges from 15 to 25 percent; cobbles, 10 to 15 percent; and stones, 15 to 30 percent.

The C horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. It is sandy loam or loam. Content of gravel ranges from 15 to 25 percent; cobbles, 10 to 15 percent; and stones, 15 to 30 percent.

Bridgeson series

The Bridgeson series consists of very deep, poorly drained soils on bottom lands and low stream terraces. These soils formed in mixed alluvium including igneous material, lacustrine sediment, volcanic ash, and loess. Slope ranges from 0 to 3 percent. Elevation ranges from 1,600 to 2,200 feet. Average annual precipitation ranges from 18 to 22 inches, and average annual air temperature is about 48° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Bridgeson silt loam; 2,400 feet south and 100 feet east of the northwest corner of sec. 2, T. 31 N., R. 40 E., of the Willamette meridian:

Ap-0 to 10 inches; gray (10YR 5/1) silt loam, black (10YR 2/1) moist; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; neutral; abrupt smooth boundary.

C1g-10 to 12 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; few fine distinct mottles, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; neutral; clear wavy boundary.

C2g-12 to 24 inches; light gray (10YR 7/1) silty clay loam, gray (10YR 5/1) moist; common fine and medium distinct mottles, dark brown (10YR 3/3) moist; strong fine and medium prismatic structure; hard, firm, sticky and plastic; common fine roots; many very fine pores; neutral; clear wavy boundary.

C3g-24 to 38 inches; light gray (10YR 7/1) silty clay loam, gray (10YR 5/1) dry; common fine and medium distinct mottles, dark brown (10YR 3/3) moist; strong medium prismatic structure; hard, firm, sticky and plastic; few fine roots, common very fine pores; few thin clay films on peds and in pores; slight effervescence; mildly alkaline; clear wavy boundary.

C4g-38 to 60 inches; gray (10YR 7/1) silty clay loam, gray (10YR 5/1) moist; common fine and medium distinct mottles, dark brown (10YR 3/3) moist; strong coarse prismatic structure; very hard, firm, sticky and plastic; few fine roots; many very fine pores; few clay films on peds and in pores; slight effervescence; mildly alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Content of clay in the control section ranges from 25 to 35 percent, and rock fragments are less than 5 percent. The soils are saturated during winter and spring. Reaction is neutral or mildly alkaline.

The A horizon has value of 4 or 5, dry and 2 through 3, moist.

The Cg horizon has value of 6 or 7, dry and 4 or 5, moist. It is heavy silt loam or silty clay loam and has thin lenses of clay loam, sandy loam, or volcanic ash.

Buhrig series

The Buhrig series consists of moderately deep, well drained soils on upper foot slopes, side slopes, and ridgetops of mountains. These soils formed it residuum and colluvium derived from igneous and metasedimentary rocks and are mantled with volcanic ash and loess. Slope ranges from 25 to 65 percent. Elevation ranges from 3,000 to 6,500 feet. Average annual precipitation ranges from 25 to 35 inches, and average annual air temperature is about 40° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Buhrig very stony loam, 40 to 65 percent slopes; 690 feet west and 200 feet south of the northeast corner of sec. 14, T. 31 N., R. 38 E , of the Willamette meridian:

O1&O2-1 inch to 0; needles, leaves, twigs, and cones; abrupt smooth boundary.

A1-0 to 4 inches; grayish brown (10YR 5/2) very stony loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine pores; 10 percent pebbles, 20 percent cobbles, and 15 percent stones on the surface; slightly acid; clear wavy boundary.

B21-4 to 12 inches; yellowish brown (10YR 5/4) extremely stony loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine pores; 10 percent pebbles, 25 percent cobbles, and 35 percent stones; slightly acid; clear wavy boundary.

B22-12 to 18 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine pores; 10 percent pebbles, 25 percent cobbles, and 40 percent stones; Slightly acid; clear wavy boundary.

C1-18 to 22 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine pores; 10 percent pebbles, 20 percent cobbles, and 40 percent stones; slightly acid; gradual wavy boundary.

R-22 inches; fractured quartzite.

Depth to bedrock ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 40° to 42° F. Content of rock fragments in the control section ranges from 50 to 90 percent. Reaction is neutral or slightly acid.

The A1 horizon has hue of 10YR or 7.5YR; value of 4 or 5, dry and 2 or 3, moist; and chroma of 2 or 3, dry or moist. Content of pebbles ranges from 10 to 15 percent; cobbles, 10 to 20 percent; and stones, 15 to 25 percent.

The B2 horizon has hue of 7.5YR or 10YR; value of 5 or 6, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. Content of pebbles ranges from 10 to 15 percent; cobbles, 15 to 25 percent; and stones, 30 to 40 percent.

The C horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. Content of pebbles ranges from 10 to 15 percent; cobbles, 20 to 30 percent; and stones, 35 to 45 percent.

Cedonia series

The Cedonia series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in glacial lake sediment and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 1,400 to 2,100 feet. Average annual precipitation ranges from 15 to 21 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Cedonia silt loam, 0 to 5 percent slopes; 2,500 feet east and 400 feet north of the southwest corner of sec. 3, T. 35 N., R. 39 E., of the Willamette meridian:

Ap-0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; neutral; abrupt smooth boundary.

B21-8 to 18 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; neutral; clear wavy boundary.

B22-18 to 32 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine pores; slight effervescence; mildly alkaline; clear smooth boundary.

C-32 to 60 inches; light gray (5Y 7/2) silt loam, olive gray (5Y 5/2) moist; moderate thin and medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; few roots; few very fine pores; strong effervescence; moderately alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F.

The A horizon has value of 5 or 6, dry and 3 or 4, moist.

The B2 horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist.

The C horizon has hue of 2.5Y or 5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist. Reaction is moderately alkaline or strongly alkaline.

Chamokane series

The Chamokane series consists of very deep, somewhat poorly drained soils on bottom lands. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,600 to 3,000 feet. Average annual precipitation ranges from 18 to 22 inches, and average air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Chamokane loam; 1,500 feet west and 50 feet south of the northeast corner of sec. 30, T. 36 N., R. 39 E., of the Willamette meridian:

A1p-0 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; mildly alkaline; abrupt smooth boundary.

A12-8 to 16 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; moderately alkaline; clear wavy boundary.

C1-16 to 26 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine and fine pores; common fine distinct mottles; neutral; clear wavy boundary.

C2-26 to 28 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; massive; weakly cemented, very hard, very firm, slightly sticky and slightly plastic; few fine roots; few fine and medium pores; neutral; clear wavy boundary.

IIC3-28 to 60 inches; multicolored, stratified gravelly loamy sand; single grain; loose; 20 percent pebbles; neutral.

These soils are saturated during winter and spring. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. The control section is less than 18 percent clay. Reaction ranges from neutral to moderately alkaline.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 0 to 25 percent.

The C1 and C2 horizons have value of 6 or 7, dry and 5 or 6, moist. They are loam or fine sandy loam. Content of gravel ranges from 0 to 15 percent.

The IIC3 horizon is loamy sand or sand. Content of pebbles ranges from 15 to 25 percent.

Cheney series

The Cheney series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in glacial outwash and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 1,400 to 2,500 feet. Average annual precipitation ranges from 15 to 17 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typical pedon of Cheney silt loam, 0 to 15 percent slopes; 1,800 feet east and 800 feet north of the southwest corner of sec. 9, T. 28 N., R. 38 E., of the Willamette meridian:

A1-0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine to medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; neutral; abrupt smooth boundary.

B2-10 to 24 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; 20 percent pebbles; neutral; clear wavy boundary.

IIC-24 to 60 inches; multicolored extremely gravelly coarse sand; single grain; loose; 60 percent pebbles, 10 percent cobbles; some gravel and cobbles have lime coatings; moderately alkaline.

Depth to contrasting sand and gravel ranges from 20 to 36 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist. It is silt loam or stony silt loam.

The B horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or silt loam. Content of pebbles ranges from 0 to 20 percent.

Content of rock fragments in the IIC horizon ranges from 50 to 75 percent.

Chewelah series

The Chewelah series consists of very deep, somewhat poorly drained soils on alluvial terraces. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,500 to 2,000 feet. Average annual precipitation ranges from 18 to 22 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Chewelah fine sandy loam; west of Chewelah, 1,800 feet south and 1,200 feet east of the northwest corner of sec. 14, T. 32 N., R. 40 E., of the Willamette meridian:

Ap-0 to 10 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many line roots; many fine pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

A1-10 to 18 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/21 moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; strong effervescence; moderately alkaline; clear wavy boundary.

C1-18 to 32 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 412) moist; few fine distinct dark brown mottles (7.5YR 4/4) moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; strong effervescence; moderately alkaline; clear wavy boundary.

C2-32 to 37 inches; very pale brown (10YR 8/3) loamy sand, pale brown (10YR 6/3) moist; few fine distinct dark brown mottles (7.5YR 4/4) moist; single grain; loose; many very fine and fine roots; many fine and very fine pores; moderately alkaline; strong effervescence; clear wavy boundary.

C3-37 to 60 inches; multicolored coarse sand; few fine dark brown mottles (7.5YR 4/4) moist; single grain; loose; strong effervescence; moderately alkaline.

Mean annual soil temperature at a depth o 20 inches ranges from 47° to 49° F. Reaction ranges from mildly alkaline to strongly alkaline. Content of rock fragments ranges from 0 to 15 percent.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist.

The C1 horizon has hue of 2.5Y or 10YR; value of 5 or 6, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist. It is sandy loam or fine sandy loam. Mottles are few or common. The C2 and C3 horizons have hue of 2.5Y or 10YR; value of 6 through 8, dry and 4 through 6, moist; and chroma of 2 or 3, dry or moist. They range from fine sandy loam to coarse sand. Mottles are few or common.

Clayton series

The Clayton series consists of very deep, well drained soils on terraces. These soils formed in mixed glaciofluvial deposits. Slope ranges from 0 to 15 percent. Elevation ranges from 1,800 to 2,000 feet. Average annual precipitation ranges from 20 to 25 inches, and average annual air temperature is about 45° F . The frost-free season ranges from 110 to 120 days.

Typical pedon of Clayton fine sandy loam, 0 to 5 percent slopes; 270 feet north and 300 feet east of the southwest corner of sec. 7, T. 28 N., R. 42 E. of the Willamette meridian:

O1-1 1/2 inches to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A2-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) moist; single grain; soft, very friable, nonsticky and nonplastic; many roots; slightly acid; abrupt smooth boundary.

B21ir-1/4 inch to 7 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many fine pores; slightly acid; clear wavy boundary.

B22ir-7 to 18 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many fine pores; neutral; clear wavy boundary.

C1-18 to 32 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common roots; many fine pores; two distinct irregular and wavy bands 1/16 to 1/8 inch thick, dark brown (10YR 4/3) moist; neutral; clear wavy boundary.

C2-32 to 60 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common roots; many fine pores; five distinct irregular wavy bands 1/16 to 1 inch thick, dark yellowish brown (10YR 4/4) moist; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Content of rock fragments ranges from 0 to 15 percent. Reaction is neutral or slightly acid.

The A2 horizon, if present, has value of 5 through 7, dry and 4 or 5, moist and chroma of 1 or 2, moist or dry.

The B horizon has hue of 10YR or 7.5YR; value of 4 through 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. It is fine sandy loam.

The C horizon has hue of 2.5Y or 10YR; value of 5 or 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry and moist. It ranges from fine sandy loam to loamy fine sand. Several irregular wavy 1/16- to 1-inch loam bands are present.

Colville series

The Colville series consists of very deep, poorly drained soils on bottom lands. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,400 to 2,000 feet. Average annual precipitation ranges from 17 to 19 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Colville silt loam; 1,200 feet south and 1,220 feet west of the northeast corner of sec. 20, T. 35 N., R. 39 E., of the Willamette meridian:

Ap-0 to 9 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine and medium granular structure; hard, friable, sticky and slightly plastic; many fine roots; common fine pores; strong effervescence; strongly alkaline; abrupt smooth boundary.

A12-9 to 17 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; common fine roots; common fine pores; strong effervescence; strongly alkaline; clear wavy boundary.

B2g-17 to 27 inches; gray (10YR 6/1) silty :lay loam, dark gray (5Y 4/1) moist; few medium distinct mottles, yellowish brown (10YR 5/8) moist; weak coarse prismatic structure; very hard, friable, sticky and plastic; few fine roots; common fine pores; strong effervescence; strongly alkaline; clear wavy boundary.

C1g-27 to 38 inches; light gray (10YR 7/1) silty clay loam, grayish brown (2.5Y 5/2) moist; few medium distinct mottles, yellowish brown (10YR 5/8) moist; massive; hard, friable, sticky and plastic; few roots; common fine pores; strong effervescence; strongly alkaline; clear wavy boundary.

C2g-38 to 54 inches; light gray (10YR 7/1) silty clay loam, gray (10YR 5/1) moist; few fine distinct mottles, dark brown (7.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; few fine roots; common fine pores; strong effervescence; moderately alkaline; clear wavy boundary.

C3g-54 to 60 inches; white (10YR 8/1) silt loam, gray (10YR 6/1) moist; few fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; mildly alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Content of clay in the control section ranges from 25 to 35 percent. Reaction ranges from mildly alkaline to strongly alkaline.

The A horizon has value of 3 through 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist.

The Bg horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 through 7, dry and 4 through 6, moist; and chroma of 1 or 2, dry or moist. It also has mottles.

The Cg horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 through 8, dry and 4 through 6, moist; and chroma of 1 or 2, dry or moist. It is silt loam, silty clay, or silty clay loam and has few to common mottles.

Dart series

The Dart series consists of very deep, somewhat excessively drained soils on terraces. These soils formed in mixed sandy alluvium. Slope ranges from 0 to 8 percent. Elevation ranges from 1,400 to 2,100 feet. Average annual precipitation ranges from 15 to 20 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Dart loamy coarse sand, 0 to 8 percent slopes; about 5 miles south of Ford, 420 feet south and 420 feet east of the northwest corner of sec. 5, T. 27 N., R. 40 E., of the Willamette meridian:

A1-0 to 2 inches; pale brown (10YR 6/3) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; neutral; clear *wavy* boundary.

B21-2 to 8 inches; brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; neutral; clear wavy boundary.

B22-8 to 14 inches; pale brown (10YR 6/3) loamy coarse sand, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; neutral; clear wavy boundary.

C1-14 to 21 inches; light brownish gray (2.5Y 6/2) coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; few fine roots; neutral; clear wavy boundary.

C2-21 to 60 inches; multicolored sand; single grain; loose; few fine roots; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from about 47° to 51 ° F. Reaction is slightly acid or neutral.

The A horizon has value of 5 or 6, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist.

The B horizon has value of 4 through 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist.

The C horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 3 or 4, moist; and chroma of 2 or 3, dry or moist.

Dearyton series

The Dearyton series consists of very deep, moderately well drained soils on toe slopes of plateaus and foothills. These soils formed in glacial till and are mantled with volcanic ash and loess. Slope ranges from 0 to 40 percent. Elevation ranges from 2,000 to 2,800 feet. Average annual precipitation ranges from 20 to 23 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 120 to 135 days.

Typical pedon of Dearyton silt loam, 5 to 15 percent slopes; 400 feet east and 800 feet north of the southwest corner of sec. 1, T. 28 N., R. 38 E., of the Willamette meridian:

O1-1 inch to 0; partially decomposed litter.

A1-0 to 6 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; slightly acid; clear wavy boundary.

B21-6 to 11 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; slightly acid; clear wavy boundary.

B22-11 to 21 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate and fine medium prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral; clear wavy boundary.

A2-21 to 27 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral; abrupt smooth boundary.

IIB21t-27 to 36 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) moist; strong coarse prismatic structure parting to strong medium subangular blocky; very hard, extremely firm, sticky and plastic; few very fine roots; many very fine pores; moderate thin continuous clay films on surface of peds and in pores; dark brown coating on peds; many clean mineral grains on fracture surfaces; neutral; clear wavy boundary.

IIB22t-36 to 60 inches; light brown (7.5YR 6/4) gravelly silty clay, brown (7.5YR 5/4) moist; massive; extremely hard, extremely firm, sticky and plastic; few very fine roots; common very fine pores; thin discontinuous clay films on fracture planes and in pores; 20 percent pebbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51 ° F. Depth to the lithologic discontinuity ranges from 18 to 30 inches. Reaction is neutral or slightly acid.

The A horizon has value of 4 or 5, dry and 3 or 4, moist and chroma of 2 or 3, dry or moist.

The B horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is silt loam or loam.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist. It is loam or silt loam.

The IIB horizon has hue of 7.5YR or 10YR; value of 5 or 6, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. It is silty clay, clay loam, or silty clay loam. Content of pebbles ranges from 0 to 20 percent.

Dehart series

The Dehart series consists of very deep, somewhat excessively drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till and colluvium derived mainly from metamorphic rock. Slope ranges from 5 to 65 percent. Elevation ranges from 1,500 to 3,500 feet. Average annual precipitation ranges from 16 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Dehart cobbly loam, 40 to 65 percent slopes; 1,400 feet south and 1,600 feet east of the northwest corner of sec. 12, T. 32 N., R. 37 E., of the Willamette meridian:

O1&O2-1 inch to 0; loose, partially decomposed organic litter of ponderosa pine needles, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 6 inches; grayish brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; 10 percent rounded pebbles and 15 percent rounded cobbles; neutral; clear wavy boundary.

B2-6 to 11 inches; pale brown (10YR 6/3) very cobbly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common medium pores; 15 percent rounded pebbles and 25 percent rounded cobbles; neutral; clear wavy boundary.

B3-11 to 30 inches; pale brown (10YR 6/3) extremely stony sandy loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; few fine, medium, and coarse pores; 10 percent rounded pebbles, 20 percent rounded cobbles, and 40 percent stones; neutral; clear wavy boundary.

C-30 to 60 inches; pale brown (10YR 6/3) extremely stony sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few roots; few pores; 10 percent rounded pebbles, 20 percent rounded cobbles, and 40 percent stones; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° F. to 51° F. Content of rock fragments in the control section ranges from 35 to 70 percent. Reaction ranges from neutral through moderately alkaline.

The A1 horizon has value of 5 or 6, dry and chroma of 2 or 3, dry or moist. It is sandy loam or loam. Content of pebbles ranges from 15 to 25 percent and cobbles, 10 to 20 percent.

The B horizon has value of 5 through 7, dry and 4 or 5, moist. Texture is loam or sandy loam. Content of pebbles ranges from 10 to 15 percent and cobbles, 20 to 35 percent.

The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. It is sandy loam or loamy fine send. Content of pebbles ranges from 10 to 20 percent; cobbles, 20 to 30 percent; and stones, 30 to 40 percent.

Donavan series

The Donavan series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in mixed glacial till, with an admixture of loess and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 2,000 to 3,500 feet. Average annual precipitation ranges from 17 to 20 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Donavan loam, 25 to 40 percent slopes; 1,100 feet west and 2,300 feet north of the southeast corner of sec. 27, T. 30 N., R. 40 E., of the Willamette meridian:

O1&O2-1 inch to 0; partially decomposed needles, cones, twigs, and grass; abrupt smooth boundary.

A11-0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine pores; 5 percent pebbles; neutral; abrupt smooth boundary.

A12-6 to 14 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; 10 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.

C1-14 to 30 inches; pale brown (10YR 6/3) cobbly sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; 10 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

C2-30 to 60 inches; light gray (2.5Y 7/2) cobbly sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard; friable, slightly sticky and slightly plastic; few fine roots; few fine pores; 10 percent pebbles and 15 percent cobbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Content of rock fragments in the control section ranges from 10 to 35 percent. Reaction is slightly acid or neutral.

The A1 horizon has value of 4 through 6, dry and 2 through 4, moist. Content of coarse fragments ranges from 5 to 40 percent. Texture is loam or stony loam.

The C horizon has hue of 10YR or 2.5Y; value of 5 through 7, dry and 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 5 to 20 percent and cobbles, 5 to 15 percent.

Dragoon series

The Dragoon series consists of moderately deep, well drained soils on toe slopes and foot slopes of foothills. These soils formed in residuum derived from granite with an admixture of volcanic ash and loess. Slope ranges from 8 to 45 percent. Elevation ranges from 2,000 to 3,000 feet. Average annual precipitation ranges from 18 to 21 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 110 to 120 days.

Typical pedon of Dragoon silt loam, 25 to 45 percent slopes; 200 feet north and 100 feet east of the southwest corner of sec. 12, T. 28 N., R. 37 E., of the Willamette meridian:

A11-0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; neutral; clear wavy boundary.

A12-8 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; neutral; clear wavy boundary.

B21t-12 to 18 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many very fine pores; clay coatings on some sand grains; neutral; clear wavy boundary.

B22-18 to 30 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak moderately fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; common thin clay films in pores; 10 percent pebbles; neutral; clear wavy boundary.

IICr-30 inches; weathered granite, crumbles to coarse sand and gravel.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Content of pebbles in the control section ranges from 0 to 15 percent. Reaction is slightly acid or neutral. Depth to weathered granite ranges from 20 to 40 inches. Thickness of the mollic epipedon ranges from 10 to 18 inches.

The A horizon has value of 4 or 5, dry and chroma of 2 or 3, moist or dry.

The B horizon has value of 4 through 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or clay loam.

Eloika series

The Eloika series consists of very deep, wall drained soils on terraces and terrace escarpments. These soils formed in ablation till or in mixed glacial outwash and ablation till and are mantled with volcanic ash and loess. Slope ranges from 0 to 40 percent. Elevation ranges from 1,800 to 3,000 feet. Average annual precipitation ranges from 22 to 28 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Eloika silt loam, 0 to 15 percent slopes; 2,600 feet north and 2,200 feet west of the southeast corner of sec. 36, T. 30 N., R. 42 F., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; medium acid; abrupt smooth boundary.

A2-0 to 1 /4 inch; light gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; slightly acid; abrupt smooth boundary.

B21ir-1 /4 inch to 3 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine pores; 3 percent pebbles; slightly acid; clear *wavy* boundary.

B22ir-3 to 14 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak medium 3ubangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B3-14 to 24 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine and fine roots; many very fine pores; 10 percent pebbles; slightly acid; clear wavy boundary.

IIC1-24 to 44 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine pores; two irregular wavy dark brown (7.5)YR 4/4) moist loam bands 1/4 inch thick; 25 percent pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

IIC2-44 to 53 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; many medium distinct mottles, dark brown (7.5YR 4/4) moist; massive, hard, friable, nonsticky and nonplastic; few roots; common very fine pores; 40 percent pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

IIIC3-53 to 60 inches; multicolored extremely gravelly coarse sand; single grain; loose; very few roots; many large mottles, dark reddish brown (5YR 5/4) moist, in the upper few inches of the horizon; 50 percent pebbles, 10 percent cobbles, and 5 percent stones; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. The upper part of the control section ranges from 35 to 60 percent pyroclastic material by weight, and content of coarse fragments is less than 15 percent. Content of rock fragments in the control section averages less than 35 percent. Reaction is neutral or slightly acid.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The B2ir horizon has hue of 7.5YR or 10YR; value of 5 through 7, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam. Content of rock fragments ranges from 0 to 5 percent. The B3 horizon has hue of 7.5YR or 10YR; value of 6 or 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. Content of rock fragments ranges from 5 to 15 percent.

The IIC horizon has value of 6 or 7, dry and 4 or 5, moist. It is loam or sandy loam. Content of coarse fragments ranges from 20 to 35 percent to a depth of 40 inches and from 35 to 70 percent below a depth of 40 inches.

The IIIC horizon is loamy sand, coarse sand, or sand. Content of coarse fragments ranges from 35 to 70 percent.

Garrison series

The Garrison series consists of very deep, somewhat excessively drained soils on terraces and alluvial fans. These soils formed in glacial outwash, with an admixture of loess or volcanic ash in the surface layer. Slope ranges from 0 to 15 percent. Elevation ranges from 1,700 to 2,500 feet. Average annual precipitation ranges from 18 to 25 inches, and average annual air temperature is about 49° F. The frost-free season ranges from 120 to 140 days.

Typical pedon of Garrison loam, 0 to 5 percent slopes; 400 feet north and 1,600 feet west of the southeast corner of sec. 34, T. 36 N., R. 39 E., of the Willamette meridian:

Ap-0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine pores; 10 percent pebbles; neutral; abrupt smooth boundary.

A12-9 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine pores; 10 percent pebbles; neutral; gradual wavy boundary.

B2-16 to 24 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine pores; 20 percent pebbles; neutral; gradual wavy boundary.

C1-24 to 60 inches; brown (10YR 5/3) very gravelly loamy coarse sand, dark brown (7.5YR 3/4) moist; massive; loose; few fine roots; 50 percent pebbles, 10 percent cobbles; mildly alkaline; gradual wavy boundary.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Depth to very gravelly 'loamy coarse sand ranges from 24 to 36 inches. Content of rock fragments in the control section ranges from 35 to 60 percent. The mollic epipedon ranges from 12 to 20 inches in thickness. Reaction is neutral or mildly alkaline.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist. Content of pebbles ranges from 5 to 30 percent.

The B horizon has value of 4 through 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is sandy loam or loam. Content of pebbles ranges from 15 to 40 percent.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 5 or 6, dry and 3 through 5, moist; and chroma of 3 through 5, dry or moist. It ranges from sandy loam to loamy coarse sand. Content of pebbles ranges from 30 to 40 percent and cobbles, 10 to 20 percent.

Green Bluff series

The Green Bluff series consists of very deep, well drained soils on basalt plateaus and foothills. These soils formed in glacial till, with an admixture of volcanic ash and loess. Slope ranges from 0 to 15 percent. Elevation ranges from 1,800 to 2,500 feet. Average annual precipitation ranges from 18 to 22 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Green Bluff silt loam, 0 to 5 percent slopes; about 1.5 miles east on Cottonwood Load from the intersection with Moses Road and about 25 feet north of roadway, 950 feet north and 3,900 feet east of the southwest corner of sec. 27, T. 29 N., R. 39 E., of the Willamette meridian:

O1&O2-1 1/2 inches to 0; grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; slightly acid; abrupt smooth boundary.

A2-0 to 1/2 inch; light gray (10YR 7/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

B21-1/2 inch to 6 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many roots; many fine pores; 5 percent pebbles; neutral; clear wavy boundary.

B22-6 to 15 inches; light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 3/4) moist; few fine faint mottles, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; 5 percent pebbles; neutral; clear wavy boundary.

B23-15 to 27 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; few fine distinct mottles, dark brown (7.5YR 3/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common roots; many fine pores; two fine (3 millimeters thick) distinct loam bands of dark brown (7.5YR 3/4) moist; 5 percent pebbles; neutral; clear wavy boundary.

B24-27 to 48 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common roots; many fine pores; two large (13 to 25 millimeters thick) distinct loam bands of dark brown (7.5YR 4/4) moist; 5 percent pebbles; neutral; clear wavy boundary.

C1-48 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few roots; common fine and medium and few coarse pores; 10 percent pebbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Content of rock fragments in the control section ranges from 5 to 15 percent. Reaction is neutral or slightly acid.

In some pedons, an Ap horizon is present that has hue of 10YR or 7.5YR; value of 5 or 6, dry and 3 through 5, moist; and chroma of 2 or 3, dry or moist. The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The B2 horizon has hue of 7.5YR or 10YR; value of 5 through 7, dry and 3 through 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam. Content of pebbles ranges from 5 to 10 percent.

The C horizon has hue of 10YR or 2.5Y; value of 5 through 7, dry and 2 through 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam, loam, or fine sandy loam. Content of coarse fragments ranges from 5 to 10 percent. Bands range from 3 to 25 millimeters in thickness and are loam or silt loam.

Hagen series

The Hagen series consists of very deep, somewhat excessively drained soils on terraces and terrace escarpments. These soils formed in mixed, sandy glacial outwash material. Slope ranges from 0 to 40 percent. Elevation ranges from 1,400 to 2,100 feet. Average annual precipitation is 18 to 20 inches, and the average annual air temperature is about 48° F. The frost-free season is 110 to 120 days.

Typical pedon of Hagen sandy loam, 0 to 15 percent slopes; 400 feet south and 400 feet east of the northwest corner of sec. 14, T. 28 N., R. 41 E., of the Willamette meridian:

O1&O2-1 1/2 inches to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A1-0 to 5 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many roots; neutral; clear wavy boundary.

C1-5 to 12 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many roots; neutral; clear wavy boundary.

C2-12 to 22 inches; very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) moist; few to common fine faint dark brown (10YR 4/3) mottles; massive; soft, very friable, nonsticky and nonplastic; many roots; neutral; clear wavy boundary.

C3-22 to 32 inches; very pale brown (10YR 7/4); loamy fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; common roots; dark brown (10YR 4/3) moist, discontinuous loam band, 1/16 to 1/8 inch thick; neutral; gradual wavy boundary.

C4-32 to 60 inches; light gray (10YR 7/2) fine and medium sand, pale brown (10YR 6/3) moist; single grain; loose; few roots; one band of dark brown (10YR 4/3) moist, but no textural difference from matrix; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Reaction is slightly acid or neutral. In some pedons, a thin or intermittent A2 horizon is present.

The A1 horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 2 or 3, dry or moist.

The C1 and C2 horizons have hue of 2.5Y or 10YR. They are sandy loam or coarse sandy loam. The C3 and C4 horizons have value of 6 or 7, dry and 4 through 6, moist and chroma of 2 through 4, dry or moist. Texture is loamy fine sand or sand. Mottles are generally below a depth of 10 to 20 inches and vary from faint to distinct. Thin wavy bands in the lower part of the C horizon vary from 1/16 to 1/8 inch in thickness. Depth to loamy fine sand or sand ranges from 12 to 24 inches.

Hardesty series

The Hardesty series consists of very deep, moderately well drained soils in basins and on bottom lands and alluvial fans. These soils formed in alluvium that is more than 60 percent volcanic ash. Slope ranges from 0 to 5 percent. Elevation ranges from 1,500 to 3,000 feet. Average annual precipitation ranges from 16 to 22 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 105 to 125 days.

Typical pedon of Hardesty silt loam, 0 to 5 percent slopes; 1,800 feet south and 100 feet west of the northeast corner of sec. 36, T. 30 N., R. 36 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, partially decomposed litter, including needles, leaves, twigs, bark, and cones; medium acid; abrupt smooth boundary.

A11-0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine pores; slightly acid; abrupt smooth boundary.

A12-4 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine pores; neutral; clear wavy boundary.

C1-15 to 31 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine pores; neutral; clear *wavy* boundary.

C2-31 to 60 inches; pale brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/4) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; weakly smeary; few very fine and fine roots; few fine pores; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. The control section is more than 60 percent pyroclastic material, and base saturation is more than 50 percent. Reaction is neutral or slightly acid.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist.

The C horizon has value of 5 through 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. Mottles range from few fine faint to common medium distinct.

Hartill series

The Hartill series consists of moderately deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of mountains. These soils formed it colluvium and residuum derived from shaly rock and are: mantled with volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 2,000 to 3,500 feet. Average annual precipitation ranges from 22 to 35 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Hartill silt loam, 40 to 65 percent slopes; 1,200 feet south and 1,800 feet west of the northeast corner of sec. 23, T. 30 N., R. 41 E., of the Willamette meridian:

O1-2 inches to 1 inch; needles, leaves, and twigs; slightly acid.

O2-1 inch to 0; partially decomposed needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A2-0 to 1/2 inch; light gray (10YR 7/1) very fine sandy loam, dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and fine roots; many very fine and fine pores; neutral; abrupt wavy boundary.

B21ir-1/2 inch to 7 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; 5 percent shaly fragments; neutral; clear wavy boundary.

B22ir-7 to 12 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; ,weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; 5 percent shaly fragments; slightly acid; clear wavy boundary.

IIC1-12 to 25 inches; very pale brown (10YR 7/4) shaly loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; 20 percent shaly fragments and 10 percent flagstones; slightly acid; clear wavy boundary.

IIC2-25 to 37 inches; pale yellow (2.5Y 7/4) very shaly loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium pores; 40 percent shaly fragments and 10 percent flagstones; slightly acid; clear wavy boundary.

R-37 inches; fractured phyllite with some fines in voids.

Depth to bedrock ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 44° to 46° F. Reaction is neutral or slightly acid. Content of coarse fragments in the control section ranges from 35 to 50 percent.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist. It is very fine sandy loam or silt loam. Content of shaly fragments ranges from 5 to 15 percent.

The B2ir horizon has hue of 10YR or 7.5YR; value of 5 or 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam. Content of shaly fragments ranges from 5 to 15 percent.

The IIC horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. It is loam or sandy loam. Content of shaly fragments ranges from 25 to 40 percent. Content of flagstones ranges from 5 to 10 percent.

Hesseltine series

The Hesseltine series consists of very deep, well drained soils on terraces and foothills. These soils formed in glacial outwash material, with an admixture of volcanic ash and loess in the upper part. Slope ranges from 0 to 25 percent. Elevation ranges from 1,700 to 2,500 feet. Average annual precipitation ranges from 17 to 22 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Hesseltine silt loam, 0 to 8 percent slopes; 1,000 feet east and 2,500 feet south of the northwest corner of sec. 29, T. 30 N., R. 37 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of pine needles, leaves, twigs, bark, and cones; medium acid; abrupt smooth boundary.

A1-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 10 percent pebbles; slightly acid; clear smooth boundary.

B21t-10 to 18 inches; pale brown (10YR 6/3) gravelly silt loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; few thin clay films on peds and in pores; 25 percent pebbles; neutral; clear *wavy* boundary.

B22t-18 to 28 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few fine pores; few thin clay films on peds and in pores; 30 percent pebbles and 10 percent cobbles neutral; clear wavy boundary.

IIC1-28 to 60 inches; multicolored extremely gravelly coarse sand; single grain; loose, nonsticky and nonplastic; few roots; 50 percent pebbles and 10 percent cobbles; some fine coatings on rock fragments; neutral.

Depth to coarse sand, gravel, cobbles, and stones ranges from 20 to 40 inches. Content of coarse fragments in the upper part of the control section ranges from 5 to 30 percent and in the lower part, 35 to 65 percent. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51 ° F. Reaction is neutral or slightly acid.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. It is silt loam or stony silt loam.

The B2t horizon has hue of 10YR or 2.5Y; value of 5 through 7, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam and is gravelly in the upper part and very gravelly in the lower part Content of rock fragments in the argillic horizon ranges from 15 to 35 percent.

Hodgson series

The Hodgson series consists of very deep, moderately well drained soils on terraces and terrace escarpments. These soils formed in glacial lake sediment and are mantled with volcanic ash and loess. Slope ranges from 0 to 40 percent. Elevation ranges from 1,600 to 2,000 feet. Average annual precipitation ranges from 16 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Hodgson silt loam, 3 to 15 percent slopes; 2,600 feet south and 2,600 feet east of the northwest corner of sec. 23, T. 34 N., R. 39 E., of the Willamette meridian:

Ap-0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; neutral; 5 percent rounded pebbles; abrupt smooth boundary.

A2-7 to 10 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine pores; neutral; few pebbles; abrupt wavy boundary.

B21t-10 to 20 inches; very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) moist; strong medium prismatic structure; very hard, very firm, sticky and very plastic; common fine roots; many very fine pores; thin, nearly continuous clay films and few thin siliceous coatings on faces of peds and in pores; neutral; 2 percent rounded pebbles; clear wavy boundary.

B22t-20 to 28 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and very plastic; few fine roots; common very fine pores; thick, nearly continuous clay films on faces of peds and in pores; slight effervescence; mildly alkaline; 2 percent rounded pebbles; gradual wavy boundary.

C1ca-28 to 38 inches; light gray (5Y 7/2) silty clay, olive gray (5Y 5/2) moist; massive (laminated); very hard, very firm, sticky and very plastic; few very fine roots; few fine pores; strong effervescence; moderately alkaline; 2 percent rounded pebbles; gradual wavy boundary.

C2ca-38 to 60 inches; white (5Y 8/2) silty clay, olive gray (5Y 5/2) moist; massive (laminated); very hard, very firm, sticky and very plastic; few fine roots; few very fine pores; strong effervescence; moderately alkaline; 2 percent rounded pebbles.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Content of clay in the control section ranges from 35 to 45 percent. Content of rounded pebbles ranges from 0 to 10 percent.

The Ap or A1 horizon has value of 5 or 6, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. The A2 horizon has value of 6 or 7, dry and 4 or 5, moist. It is silt loam or very fine sandy loam.

The B2t horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist. It is silty clay loam, clay loam, or silty clay. Clay films range from thin to thick and are nearly continuous.

The Cca horizon has hue of 2.5Y or 5Y; value of 6 through 8, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist. It is silty clay loam or silty clay. Reaction is mildly alkaline or moderately alkaline.

Huckleberry series

The Huckleberry series consists of moderately deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of mountains. These soils formed in colluvium and residuum derived from shaly rock and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 3,000 to 6,000 feet. Average annual precipitation ranges from 30 to 45 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 70 to 90 days.

Typical pedon of Huckleberry silt loam, 30 to 65 percent slopes; described in a unit of Huckleberry-Rock outcrop complex, 30 to 65 percent slopes; 300 feet east and 400 feet north of the southwest corner of sec. 12, T. 29 N., R. 37 E., of the Willamette meridian:

O1-2 inches to 1 inch; needles and twigs; medium acid.

O2-1 inch to 0; partially decomposed needles and twigs; slightly acid; abrupt smooth boundary.

A2-0 to 1 inch; light gray (10YR 7/1) very fire sandy loam, dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; neutral; abrupt smooth boundary.

B2ir-1 inch to 14 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; 10 percent shaly fragments; slightly acid; abrupt smooth boundary.

IIC1-14 to 21 inches; pale brown (10YR 6/3) shaly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; 25 percent shaly fragments and 5 percent flagstones; few thin discontinuous clay films on faces of peds and in pores; slightly acid; gradual wavy boundary.

IIC2-21 to 28 inches; pale brown (10YR 6/3) very shaly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; 35 percent shaly fragments and 15 percent flagstones; few thin patchy clay films on faces of peds and ire pores; neutral; gradual wavy boundary.

IIC3-28 to 32 inches; light brownish gray (2.5Y 6/2) very shaly loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; 45 percent shaly fragments and 20 percent flagstones; slightly acid; abrupt wavy boundary.

R-32 inches; fractured phyllite with some fires in the fractures.

Depth to bedrock ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 40° to 45° F. The control section is dominantly silt loam or loam that is modified by 35 to 60 percent rock fragments by weighted average. Reaction ranges from neutral to medium acid.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist. It is silt loam, loam, or very fine sandy loam.

The B2ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 or 6, dry and 3 or 4, moist; and chroma of 2 through 4, dry or moist. It is silt loam or loam that is modified by 5 to 25 percent shale fragments.

The IIC horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 3 or 4, moist; and chroma of 2 through 4, dry or moist. It is modified by 20 to 40 percent shale fragments and 15 to 35 percent flagstones.

Hunters series

The Hunters series consists of very deep, well drained soils on terraces. These soils formed in calcareous, mixed glacial lake sediment, with an admixture of volcanic ash and loess. Slope ranges from 0 to 15 percent. Elevation ranges from 1,500 to 2,300 feet. Average annual precipitation ranges from 15 to 18 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 125 days.

Typical pedon of Hunters silt loam, 0 to 5 percent slopes; about 3/4 mile northwest of Hunters, 50 feet south and 800 feet west of the northeast corner of sec. 12, T. 30 N., R. 36 E., of the Willamette meridian:

Ap-0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; neutral; gradual wavy boundary.

A12-7 to 14 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; neutral; gradual wavy boundary.

A13-14 to 18 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; mildly alkaline; gradual wavy boundary.

IIB2ca-18 to 30 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; strong effervescence; moderately alkaline; abrupt wavy boundary.

IIIC1ca-30 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate thin and medium platy structure; hard, firm, slightly sticky and slightly plastic; common thin strata of very fine sandy loam; strong effervescence; moderately alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Thickness of the mollic epipedon ranges from 10 to 20 inches. Depth to soft powdery lime accumulations ranges from 20 to 34 inches.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 or 2, dry and moist. Reaction is neutral or mildly alkaline.

The B horizon has value of 5 or 6, dry and 3 or 4, moist. Reaction is mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is stratified with silt loam and very fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Inkler series

The Inkler series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till, colluvium, and residuum, with an admixture of volcanic ash in the upper part. Slope ranges from 0 to 65 percent. Elevation ranges from 2,200 to 4,500 feet. Average annual precipitation ranges from 25 to 35 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Inkler gravelly silt loam, 20 to 40 percent slopes; 2.75 miles east and 1 mile north of the north end of Pierre Lake on a logging spur, 1,100 feet south and 600 feet east of the northwest corner of sec. 34, T. 40 N., R. 37 E., of the Willamette meridian:

A1-0 to 4 inches; gray (10YR 5/1) gravelly silt loam, very dark gray (10YR 3/1) moist; weak medium and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine roots; 20 percent angular pebbles; slightly acid; clear wavy boundary.

B21-4 to 9 inches; pale brown (10YR 6/3) gravelly silt loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; soft., friable, slightly sticky and slightly plastic; common fine and medium roots; 20 percent angular pebbles; slightly acid; clear wavy boundary.

B22-9 to 21 inches; pale brown (10YR 6/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common medium roots; root mat at lower boundary; 25 percent angular pebbles; slightly acid; clear wavy boundary.

C1-21 to 31 inches; light brownish gray (2.5Y 6/2) very gravelly loam, very dark grayish brown (2,5Y 3/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; many fine tubular pores; 30 percent pebbles, 10 percent cobbles, and 5 percent stones; slightly acid; gradual wavy boundary.

C2-31 to 46 inches; light brownish gray (2.5Y 6/2) very cobbly loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; common medium tubular pores; 30 percent pebbles, 20 percent cobbles, and 10 percent stones; clay bridging of sand grains; neutral; gradual wavy boundary.

C3-46 to 60 inches; pale yellow (5Y 7/3) very cobbly sandy clay loam, olive (5Y 5/3) moist; massive; hard, firm, sticky and plastic; 25 percent pebbles, 25 percent cobbles, and 10 percent stones; clay bridging of sand grains; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 44° to 46° F. Content of clay in the control section is less than 18 percent, and content of rock fragments is more than 35 percent by weighted average. Reaction is slightly acid or neutral.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 through 3, dry or moist. Content of pebbles ranges from 10 to 25 percent.

The B2 horizon has value of 5 or 6, dry and 3 through 5, moist and chroma of 2 or 3, dry or moist. It is loam or silt loam and is gravelly or very gravelly. Content of rock fragments ranges from 20 to 55 percent.

The upper part of the C horizon has hue of 5Y or 2.5Y value of 5 through 7, dry and 3 or 4, moist; and chroma of 2 or 3, dry or moist. It is loam or silt loam and is very gravelly or very cobbly. Content of rock fragments ranges from 40 to 60 percent. The lower part of the C horizon has hue of 2.5Y or 5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is loam, silt loam, or sandy clay loam and is very gravelly or very cobbly. Content of rock fragments ranges from 50 to 60 percent.

Kegel series

The Kegel series consists of very deep, somewhat poorly drained soils on low alluvial terraces. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 2,500 to 4,000 feet. Average annual precipitation ranges from 20 to 35 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Kegel loam; 1,200 feet south and 1,420 feet east of the northwest corner of sec. 13, T. 36 N., R. 41 E., of the Willamette meridian:

O1-1 inch to 0; partially decomposed needles, leaves, bark, and cones; abrupt smooth boundary.

A11-0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate fine and granular structure; soft, very friable, slightly sticky and slightly plastic; many medium and fine roots; common fine pores; slightly acid; clear wavy boundary.

A12-8 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common medium and fine roots; common fine pores; 5 percent pebbles; neutral; clear smooth boundary.

IIC1-14 to 19 inches; brown (7.5YR 5/2) very gravelly loamy sand, dark brown (7.5YR 3/2) moist; single grain; loose, few fine roots; 45 percent pebbles; neutral; abrupt smooth boundary.

IIIA11b-19 to 26 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; few fine distinct mottles, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; 10 percent pebbles; neutral; gradual wavy boundary.

IIIA12b-26 to 38 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; many large distinct mottles, dark yellowish brown (10YR 4/4) moist; bands of olive brown (2.5Y 4/4) moist loam; matrix is massive and bands are moderate, medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; 10 percent pebbles; slightly acid; abrupt wavy boundary.

IVC2g-38 to 60 inches; light olive brown (2.5Y 5/4) very gravelly loamy coarse sand, olive brown (2.5Y 4/4) moist; single grain; loose; 40 percent pebbles; mildly alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 44° to 46° F. The soils are generally moist and are saturated during winter and spring. Reaction ranges from slightly acid to mildly alkaline. Content of rock fragments in the control section is a weighted average of less than 35 percent.

The A horizon has value of 3 through 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist. Content of pebbles ranges from 0 to 5 percent.

The IIC horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 5 through 7, dry and 3 through 6, moist; and chroma of 2 through 4, dry or moist. It is gravelly and very gravelly sandy loam. Loamy sand lenses are at any depth within the control section.

The buried A horizon has hue of 10YR or 2.5Y; value of 3 through 5, dry and 2 through 4, moist; and chroma of 0 through 3, dry or moist. It is silt loam, loam, or sandy loam. Mottles range from few fine to many large and have hue of 7.5YR, 10YR, and 2.5Y.

The IVC horizon has hue of 2.5Y or 5Y and is sandy loam or loamy coarse sand that is gravelly or very gravelly.

Kiehl series

The Kiehl series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in glacial outwash, with an admixture of volcanic ash and loess in the upper part. Slope ranges from 0 to 65 percent. Elevation ranges from 2,000 to 3,000 feet. Average annual precipitation ranges from 25 to 28 inches, and average annual air temperature is about 42° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Kiehl gravelly silt loam, 0 to 20 percent slopes; on Flat Creek, 1,800 feet west and 2,840 feet north of the southeast corner of sec. 20, T. 40 N., R. 38 E., of the Willamette meridian:

O1-1 inch to 0; partially decomposed leaves, twigs, needles, and grass roots.

B21ir-0 to 11 inches; pink (7.5YR 7/4) gravelly silt loam, strong brown (7.5YR 5/6) moist; weak fine granular and weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; many fine roots; 20 percent pebbles; slightly acid; clear wavy boundary.

B22ir-11 to 22 inches; very pale brown (10YR 7/4) gravelly fine sandy loam, yellowish brown (10YR 5/8) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine roots, with concentration of roots at lower boundary; 20 percent pebbles, 10 percent cobbles; slightly acid; clear wavy boundary.

C1-22 to 28 inches; very pale brown (10YR 7/3) extremely gravelly loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose, common fine roots; 40 percent pebbles, 20 percent cobbles, 10 percent stones; slightly acid; clear wavy boundary.

C2-28 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy coarse sand, brown (10YR 5/3) moist; single grain; loose; fine roots; 45 percent pebbles, 20 percent cobbles, 10 percent stones; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 43° to 45° F.

The Bir horizon has hue of 7.5YR or 10YR; value of 5 through 7, dry; and chroma of 3 or 4, dry. It is loam, silt loam, or fine sandy loam. Content of rock fragments ranges from 20 to 40 percent.

The C horizon has value of 6 through 8, dry and chroma of 3 or 4, dry. It is loamy sand to coarse sand. Content of rock fragments ranges from 50 to 80 percent. This horizon has some clay bridging of sand grains.

Koerling series

The Koerling series consists of very deep, moderately well drained soils on terraces and terrace escarpments. These soils formed in glaciofluvial material, with an admixture of volcanic ash and loess, and are underlain by stratified lake sediment. Slope is 0 to 65 percent. Elevation is 1,500 to 2,000 feet. The average annual precipitation is 16 to 18 inches, and the average annual air temperature is about 46° F. The frost-free season is 110 to 130 days.

Typical pedon of Koerling fine sandy loam, 0 to 5 percent slopes; 240 feet west and 2,410 feet north of the southeast corner of sec. 29, T. 36 N., R. 38 E., of the Willamette meridian:

Ap-0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and nonplastic; many roots; neutral; abrupt smooth boundary.

B21-9 to 22 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many roots; common very fine pores; neutral; gradual wavy boundary.

B22-22 to 40 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine roots; common very fine and fine pores; mildly alkaline; clear wavy boundary.

IICca-40 to 60 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive with laminations; very hard, firm, sticky and plastic; few fine roots; few fine and very fine pores; dark brown organic or manganese coating on surface of plates; slight effervescence; moderately alkaline

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 52° F. Depth to lake sediment ranges from 24 to 40 inches.

The A1 or Ap horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 2 or 3, dry or moist. It is fine sandy loam or silt loam.

The B horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 2 through 4, dry or moist. It is sandy loam or fine sandy loam. Reaction is neutral or mildly alkaline.

The IIC horizon has hue of 10YR or 2.5Y; value of 5 through 7, dry and 4 through 6, moist; and chroma of 1 through 3, dry or moist. It ranges from loam to silty clay loam. Reaction is mildly alkaline or moderately alkaline.

Konner series

The Konner series consists of very deep, somewhat poorly drained soils on bottom lands and in depressional areas. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,700 to 2,000 feet. Average annual precipitation ranges from 16 to 22 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Konner silty clay loam; 2,400 feet south and 300 feet west of the northeast corner of sec. 5, T. 28 N., R. 40 E., of the Willamette meridian:

Ap-0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and plastic; many roots; slightly acid; abrupt smooth boundary.

A1-7 to 17 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; many roots; many very fine pores; neutral; clear wavy boundary.

B21tg-17 to 28 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; few fine faint mottles, dark brown (10YR 4/3) moist; strong fine subangular blocky structure; very hard, very firm, sticky and plastic; many roots; many very fine pores; few thin clay films on faces of peds and in pores; neutral; clear wavy boundary.

B22tg-28 to 45 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; common fine and medium distinct mottles, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; common roots; many very fine pores; few thin clay films on faces of peds and in pores; neutral; clear wavy boundary.

IICg-45 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, sticky and plastic; few roots; common very fine pores; few thin clay films in pores; neutral.

The soil is moist in all horizons during most of the year and is saturated below a depth of about 12 inches during winter and spring. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. The mollic epipedon ranges from 30 to 40 inches in thickness. Reaction is slightly acid or neutral.

The A horizon has value of 4 or 5, dry and 2 or 3, moist.

The B2 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 through 3, dry or moist. It is silty clay loam or clay loam. Mottles range from few fine faint to common medium distinct.

The IIC horizon has value of 5 or 6, dry and 4 or 5, moist and chroma of 2 or 3, dry or moist. It is silty clay loam or clay loam. Mottles range from few fine faint to common medium distinct.

Koseth series

The Koseth series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in calcareous glacial till, with an admixture of volcanic ash and loess in the surface layer. Slope ranges from 15 to 65 percent. Elevation ranges from 1,600 to 4,000 feet. Average annual precipitation ranges from 15 to 30 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Koseth loam, 15 to 40 percent slopes; 2,400 feet north and 50 feet west of the southeast corner of sec. 20, T. 36 N., R. 40 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse granular structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many fine pores; 10 percent rounded pebbles; neutral; clear wavy boundary.

B2-3 to 8 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many fine pores; 15 percent rounded pebbles; mildly alkaline; clear wavy boundary.

B3-8 to 16 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many fine pores; 20 percent rounded pebbles; mildly alkaline; strong effervescence; clear wavy boundary.

C1-16 to 31 inches; pale yellow (5Y 7/3) gravelly loam, olive (5Y 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine pores; 25 percent rounded pebbles; moderately alkaline; violent effervescence; clear *wavy* boundary.

C2-31 to 44 inches; pale yellow (2.5Y 7/4) gravelly loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few roots; few fine pores; 30 percent rounded pebbles; moderately alkaline; violent effervescence; clear wavy boundary.

C3-44 to 60 inches; pale yellow (2.5Y 7/4) very gravelly loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few pores; 40 percent rounded pebbles; moderately alkaline; violent effervescence.

Mean annual soil temperature at a depth of 20 inches ranges from 48° to 50° F. The control section has a weighted average of rounded pebbles and cobbles that ranges from 15 to 35 percent.

The A1 horizon has chroma of 2 or 3, dry or moist. Content of pebbles ranges from 5 to 10 percent. Reaction is neutral or mildly alkaline.

The B horizon has value of 6 or 7, dry and 4 or 5, moist. Content of pebbles ranges from 15 to 30 percent. Reaction is neutral or mildly alkaline.

The C horizon has hue of 2.5Y or 5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. Content of pebbles ranges from 15 to 30 percent in the upper part and from 35 to 50 percent in the lower part. Reaction is mildly alkaline or moderately alkaline.

Laketon series

The Laketon series consists of very deep, moderately well drained soils on terraces. These soils formed in glacial lake sediment and are mantled with volcanic ash and loess. Slope ranges from 0 to 15 percent. Elevation ranges from 1,800 to 2,500 feet. Average annual precipitation ranges from 20 to 26 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Laketon silt loam, 0 to 5 percent slopes; 1,900 feet south and 1,650 feet east of the northwest corner of sec. 29, T. 28 N., R. 39 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, partially decomposed litter of pine needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A2-0 to 2 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many roots; many very fine pores; slightly acid; abrupt smooth boundary.

B1-2 to 8 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; many roots; many very fine pores; slightly acid; 5 percent pebbles; clear wavy boundary.

IIB21-8 to 16 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many very fine pores; neutral; 5 percent pebbles; clear wavy boundary.

IIB22-16 to 27 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common roots; many very fine pores; neutral; 5 percent pebbles; clear wavy boundary.

IIC1-27 to 37 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; very hard, very firm, sticky and plastic; common roots; common very fine pores; few dark yellowish brown (10YR 4/4) moist silty clay bands 10 to 20 millimeters thick; neutral; clear wavy boundary.

IIC2-37 to 60 inches; light gray (10R 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few roots; common very fine pores; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Content of rounded pebbles in the control section is as much as 5 percent. Reaction is neutral or slightly acid throughout the profile.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist. It is not present in some pedons and where the soil is cultivated.

The IIB2 horizon has hue of 7.5YR or 10YR; value of 6 or 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam or very fine sandy loam. Some pedons have bands of clay loam, silty clay, or clay. These bands range from 5 to 25 millimeters in thickness.

The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 or 3, dry or moist. It is stratified silt loam and silty clay loam.

Leadpoint series

The Leadpoint series consists of moderately deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of foothills. These soils formed in glacial till, residuum, and colluvium derived from shale, with an admixture of volcanic ash and loess in the surface layer. Slope ranges from 0 to 65 percent. Elevation ranges from 2,500 to 5,000 feet. Average precipitation ranges from 22 to 32 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Leadpoint silt loam, 25 to 40 percent slopes; 1,200 feet south and 800 feet west of the northeast corner of sec. 18, T. 39 N., R. 41 E., of the Willamette meridian:

O1&O2-2 inches to 0; very dark grayish broom (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; slightly acid; abrupt smooth boundary.

A1-0 to 9 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and common medium and coarse roots; many fine pores; 5 percent soft and 5 percent hard shale fragments; mildly alkaline; clear wavy boundary.

IIB21-9 to 15 inches; very dark gray (N 3/0) shaly silt loam, black (N 2/0) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many fine and common medium and coarse roots; many fine pores; 10 percent soft and 15 percent hard shale fragments; mildly alkaline; clear wavy boundary.

IIB22-15 to 24 inches; very dark gray (N 3/0)) shaly silt loam, black (N 2/0) moist; weak medium end coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine pores; 20 percent soft and 25 percent hard shale fragments; mildly alkaline; clear wavy boundary.

IlC1-24 to 34 inches; black (N 2/0) shaly loam, black (N 2/0) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; common fine pores; 30 percent soft and 30 percent hard shale fragments: moderately alkaline; abrupt irregular boundary.

IIC2-34 to 38 inches; black (N 2/0) shaly loam, black (N 2/0) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; 40 percent soft and 35 percent hard shale fragments; moderately alkaline; abrupt irregular boundary.

C3r-38 inches; fractured black (N 2/0) carbonaceous shale.

Depth to a paralithic contact ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of soft shale fragments in the control section ranges from 10 to 40 percent, and content of hard shale fragments ranges from 15 to 35 percent. Reaction is neutral to moderately alkaline.

The A1 horizon has hue of 10YR, 2.5Y, or is neutral; value of 3 through 5, dry and 2 or 3, moist; and chroma of 0 through 2, dry or moist. Content of soft and hard shale fragments ranges from 5 to 15 percent each.

The IIB horizon has hue of 2.5Y, 5Y, or is neutral; value of 2 through 5, dry and 2 or 3, moist; and chroma of 0 or 1, dry or moist. It is loam or silt loam. Content of soft shale fragments ranges from 10 to 20 percent and content of hard shale fragments, from 15 to 25 percent.

The IIC horizon has hue of 2.5Y, 5Y, or is neutral; value of 2 through 5, dry and 2 or 3, moist; and chroma of 0 or 1, dry or moist. Content of soft shale fragments ranges from 15 to 45 percent and content of hard shale fragments, from 20 to 35 percent.

Maki series

The Maki series consists of moderately deep, well drained soils on foot slopes and side slopes of foothills. These soils formed in residuum, colluvium, and glacial till derived from calcareous rock, with an admixture of volcanic ash and loess in the surface layer. Slope ranges from 25 to 65 percent. Elevation ranges from 1,400 to 4,500 feet. Average annual precipitation ranges from 15 to 25 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typical pedon of Maki gravelly loam, 40 to 65 percent slopes; 2,800 feet south of the northwest corner of sec. 28, T. 34 N., R. 38 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark brown (10YR 2/2) moist, loose, partially decomposed organic litter of ponderosa pine needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 8 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine pores; 25 percent pebbles; slight effervescence; moderately alkaline; clear wavy boundary.

B21-8 to 12 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; few fine pores; 30 percent pebbles, 10 percent cobbles; slight effervescence; moderately alkaline; clear *wavy* boundary.

B22-12 to 23 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; 40 percent pebbles, 15 percent cobbles and stones; slight effervescence; mildly alkaline; abrupt irregular boundary.

R-23 inches; fractured hard, calcareous shale.

Depth to a lithic contact ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 48° to 50° F. Content of pebbles, cobbles, and stones in the control section ranges from 35 to 70 percent. Reaction is mildly alkaline or moderately alkaline.

The A1 horizon has value of 5 or 6, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of pebbles ranges from 20 to 35 percent.

The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. It is loam or silt loam. Content of pebbles ranges from 30 to 55 percent and content of cobbles and stones, from 5 to 15 percent.

Manley series

The Manley series consists of very deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of foothills. These soils formed in glacial till and are mantled with volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 4,500 to 6,500 feet. Average annual precipitation ranges from 25 to 45 inches, and average annual air temperature is about 40° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Manley silt loam, 40 to 65 percent slopes; 2,600 feet north and 1,600 feet west of the southeast corner of sec. 18, T. 37 N., R. 40 E., of the Willamette meridian:

O1&O2-2 inches to 0; very dark brown (10YR 2/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

B21-0 to 7 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common roots; many fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B22-7 to 14 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common roots; many fine pores; 5 percent pebbles; medium acid; clear wavy boundary.

B23-14 to 18 inches; very pale brown (10YR 7/3) loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common pores; 10 percent pebbles; slightly acid; clear wavy boundary.

IIC1-18 to 30 inches; pale olive (5Y 6/3) very cobbly loam, olive (5Y 4/3) moist; common medium distinct mottles, olive brown (2.5Y 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few roots; few pores; 20 percent pebbles and 30 percent cobbles; slightly acid; clear wavy boundary.

IIC2-30 to 60 inches; pale yellow (5Y 7/3) extremely stony sandy loam, olive (5Y 4/3) moist; many large distinct mottles, olive brown (2.5Y 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few roots; few pores; 15 percent pebbles, 20 percent cobbles, and 30 percent stones; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 40° to 42° F. Content of volcanic ash in the upper part of the control section is at least 60 percent, and content of rock fragments is 0 to 20 percent. Content of rock fragments in the lower part of the control section ranges from 35 to 70 percent. Reaction ranges from neutral to medium acid.

The B2 horizon has value of 3 through 5, moist. Content of pebbles ranges from 0 to 15 percent.

The IIC horizon has value of 4 or 5, moist and chroma of 3 or 4, dry or moist. Mottles range from common medium distinct to many large prominent. Content of pebbles ranges from 15 to 40 percent; cobbles, 10 to 30 percent; and stones, 10 to 30 percent.

Marble series

The Marble series consists of very deep, excessively drained soils on terraces that have dunelike relief. These soils formed in wind-worked, mixed sandy outwash. Slope ranges from 5 to 25 percent. Elevation ranges from 1,500 to 2,500 feet. Average annual precipitation ranges from 15 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Marble loamy sand, 5 to 25 percent slopes; 1,300 feet west of the southeast corner of sec. 16, T. 28 N., R. 37 E., of the Willamette meridian:

O1&O2-1/4 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A1-0 to 8 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots; few fine pores; neutral; clear wavy boundary.

C1-8 to 30 inches; light brownish gray (2.5Y 6/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; loose; common fine roots; few fine pores; few thin (1 millimeter to 4 millimeters) distinct irregular sandy loam lamellae, dark brown (10YR 3/3) moist; neutral; gradual wavy boundary.

C2-30 to 60 inches; multicolored coarse sand; single grain; loose; few roots; neutral.

Depth to coarse sand ranges from 20 to 4C inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Reaction is neutral or slightly acid. Content of pebbles ranges from 0 to 5 percent throughout the profile.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist.

The C horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry and 3 through 5, moist; and chroma of 2 through 4, dry or moist. It is loamy sand or coarse sand. Lamellae are *wavy* or irregular and have texture of sandy loam or loamy fine sand.

Martella series

The Martella series consists of very deep, moderately well drained soils on terraces and terrace escarpments. These soils formed in glacial lake sediment and are mantled with volcanic ash and loess. Slope ranges from 0 to 40 percent. Elevation ranges from 2,000 to 3,000 feet. Average annual precipitation ranges from 20 to 30 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Martella silt loam, 5 to 15 percent slopes; 1,600 feet south and 1,450 feet east of the northwest corner of sec. 22, T. 30 N., R. 40 E., of the Willamette meridian:

O1&O2-2 1/2 inches to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; medium acid; abrupt smooth boundary.

A2-0 to 1 /4 inch; light gray (10YR 7/1) very fine sandy loam, dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

B21ir-1 /4 inch to 9 inches; very pale brown (10YR 7/3) silt loam, dark brown (7.5YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many roots; many fine pores; less than 5 percent pebbles; neutral; clear wavy boundary.

B22ir-9 to 13 inches; very pale brown (10YR 7/3) silt loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many roots; many fine pores; less than 5 percent pebbles; neutral; clear wavy boundary.

IIB23-13 to 24 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) moist; moderate medium prismatic structure; very hard, firm, sticky and plastic; many roots; few fine pores; few thin silt flour coatings in pores; less than 5 percent pebbles; slightly acid; clear wavy boundary.

IIB24-24 to 30 inches; light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium and coarse prismatic structure; very hard, firm, sticky and plastic; common roots; few fine pores; few thin clay films on peds and in pores; less than 5 percent pebbles; slightly acid; clear wavy boundary.

IIC1-30 to 40 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive and laminated; very hard, firm, slightly sticky and slightly plastic; few roots; few fine pores; neutral; clear smooth boundary.

IIC2-40 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive and laminated; very hard, very firm, slightly sticky and slightly plastic; few roots; few fine pores; mildly alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of rounded pebbles in the control section ranges from 0 to 5 percent.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The B2ir horizon has value of 6 or 7, dry and 3 through 5, moist. Content of pebbles ranges from 0 to 5 percent. Reaction is neutral or slightly acid.

The IIB2 horizon has hue of 10YR or 2.5Y; value of 5 through 7, dry and 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is very fine sandy loam, silt loam, or silty clay loam. Content of pebbles ranges from 0 to 5 percent. Reaction ranges from slightly acid to mildly alkaline.

The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 through 8, dry and 4 through 6, moist; and chroma of 2 or 3, dry or moist. It is very fine sandy loam, silt loam, or silty clay loam. Content of pebbles ranges from 0 to 5 percent. Reaction is neutral or mildly alkaline.

Merkel series

The Merkel series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till derived mainly from granite, with an admixture of volcanic ash in the upper part. Slope ranges from 0 to 65 percent. Elevation ranges from 3,000 to 4,500 feet. Average annual precipitation ranges from 22 to 35 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Merkel stony sandy loam, 0 to 40 percent slopes; 1,200 feet north and 1,700 feet east of the southwest corner of sec. 12, T. 35 N., R. 40 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A2-0 to 1/4 inch; light gray (10YR 7/1) stony very fine sandy loam, dark gray (10YR 4/1) moist; massive; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

B21-1/4 inch to 9 inches; brown (10YR 5/3) stony sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many fine pores; 15 percent pebbles, 5 percent cobbles, and 10 percent stones; slightly acid; gradual wavy boundary.

B22-9 to 16 inches; pale brown (10YR 6/3) stony sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many fine pores; 15 percent pebbles, 5 percent cobbles, and 10 percent stones; slightly acid; clear wavy boundary.

IIC1-16 to 25 inches; pale brown (10YR 6/3) very cobbly coarse sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common roots; many fine pores; 25 percent pebbles, 20 percent cobbles, and 5 percent stones; slightly acid; clear wavy boundary.

IIC2-25 to 60 inches; light brownish gray (2.5Y 6/2) very cobbly coarse sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few roots; 25 percent pebbles, 25 percent cobbles; 5 percent stones; medium acid.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of rock fragments in the control section ranges from 40 to 60 percent. Reaction ranges from neutral to medium acid.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist.

Content of pebbles in the B horizon ranges from 5 to 15 percent; cobbles, 0 to 5 percent; and stores, 5 to 10 percent.

The C horizon has value of 6 or 7, dry and chroma of 2 through 4, dry or moist. It ranges from very cobbly sandy loam to very cobbly loamy coarse sand.

Mobate series

The Mobate series consists of shallow, well drained soils on foot slopes, side slopes, and ridgetops of mountains. These soils formed in residuum derived from granite, with an admixture of volcanic ash and loess in the surface layer. Slope ranges from 0 to 65 percent. Elevation ranges from 2,500 to 4,500 feet. Average annual precipitation ranges from 22 to 35 inches, and average air temperature is about 44° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Mobate gravelly loam, 30 to 65 percent slopes; 1/2 mile west of Loon Lake, 1,600 feet west and 100 feet north of the southeast corner of sec. 4, T. 29 N., R. 41 E., of the Willamette meridian:

O1-1 inch to 0; needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and nonplastic; many fine and medium roots; many fine pores; 20 percent pebbles; slightly acid; clear wavy boundary.

B2-3 to 10 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; common fine pores; 25 percent pebbles; slightly acid; clear wavy boundary.

C1-10 to 16 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; few fine pores; 40 percent pebbles; slightly acid; clear wavy boundary.

C2r-16 inches; slightly weathered granite.

Depth to a paralithic contact ranges from 14 to 20 inches. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Reaction is slightly acid or neutral throughout the profile. Content of coarse fragments in the control section is more than 35 percent by weighted average.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of pebbles ranges from 15 to 25 percent.

The B horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 15 to 30 percent.

The C1 horizon has value of 5 through 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. Content of pebbles ranges from 35 to 55 percent. Texture is loam or sandy loam.

Molcal series

The Molcal series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in calcareous shaly rock, glacial till, and glacial lake sediment and are mantled with loess and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 1,400 to 3,000 feet. Average annual precipitation ranges from 14 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 130 days.

Typical pedon of Molcal silt loam, 0 to 8 percent slopes; 1,000 feet west and 100 feet south of the northeast corner of sec. 27, T. 30 N., R. 37 E., of the Willamette meridian:

Ap-0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; 10 percent pebbles; calcareous, moderately alkaline; abrupt smooth boundary.

A12-8 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; few fine pores; 10 percent pebbles; calcareous, moderately alkaline; clear wavy boundary.

IIB2ca-18 to 22 inches; light gray (5Y 7/2) silt loam, olive (5Y 5/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots; few fine pores; 10 percent pebbles; calcareous; few soft masses of lime; strongly alkaline; clear wavy boundary.

IICca-22 to 60 inches; light gray (5Y 7/2) gravelly silt loam, olive (5Y 5/3) moist; moderate thin and medium platy structure; hard, firm, slightly sticky and slightly plastic; few fine roots; few fine pores; 20 percent pebbles; organic coatings and thin patchy clay films on upper surfaces of plates; calcareous; few soft masses of lime; strongly alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 52° F. Content of rock fragments in the control section ranges from 5 to 35 percent. The mollic epipedon ranges from 12 to 20 inches in thickness.

The A horizon has chroma of 1 or 2, dry or moist. It is loam or silt loam. Reaction is mildly alkaline or moderately alkaline. Content of pebbles ranges from 0 to 20 percent.

The B horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 through 3, dry or moist. It is silt loam or loam. Content of pebbles ranges from 0 to 20 percent. Reaction is moderately alkaline or strongly alkaline.

The C horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 through 3, dry or moist. It is silt loam or loam. Content of pebbles ranges from 0 to 20 percent. Reaction is moderately alkaline or strongly alkaline.

Moscow series

The Moscow series consists of moderately deep, well drained soils on foot slopes, side slopes, and ridgetops of mountains. These soils formed in granitic residuum and colluvium and are mantled with volcanic ash and loess in the upper part. Slope ranges from 0 to 65 percent. Elevation ranges from 2,200 to 4,000 feet. Average annual precipitation ranges from 22 to 35 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 80 to 100 days.

Typical pedon of Moscow silt loam, 0 to 25 percent slopes; about 2 miles northwest of Clayton, 800 feet east, and 100 feet south of the northwest corner of sec. 14, T. 29 N., R. 41 E., of the Willamette meridian:

O1&O2-1 1/2 inches to 0, very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter, including needles, leaves, twigs, bark, cones, and grass; slightly acid; abrupt smooth boundary.

A2-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

B21-1/4 inch to 6 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; many very fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B22-6 to 14 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; many very fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

IIB3-14 to 26 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine pores; few dark yellowish brown (10YR 3/4) moist, thin to medium (2 to 6 millimeters) wavy loam bands; 10 percent fine pebbles; slightly acid; clear wavy boundary.

Cr-26 inches; pale yellow (2.5Y 7/4) granitic gruss, light olive brown (2.5Y 5/4) moist; slightly acid.

Depth to a paralithic contact ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of granitic pebbles in the control section ranges from 5 to 35 percent. Reaction ranges from slightly acid to strongly acid throughout the profile.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The B2 horizon has hue of 7.5YR or 10YR and value of 3 through 5, moist. It is silt loam or loam. Content of pebbles ranges from 0 to 15 percent.

The IIB3 horizon has value of 5 through 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. It is sandy loam or coarse sandy loam. Content of pebbles ranges from 5 to 35 percent.

Narcisse series

The Narcisse series consists of very deep, moderately well drained soils on bottom lands and in depressional areas. These soils formed in mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,700 to 3,000 feet. Average annual precipitation ranges from 16 to 24 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Narcisse silt loam; about 10 miles northwest of Wellpinit, 1,800 feet north and 2,400 feet east of the southwest corner of sec. 14, T. 28 N., R. 37 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter, including needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A11-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; 2 percent pebbles; slightly acid; clear wavy boundary.

A12-10 to 18 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; 3 percent pebbles; slightly acid; clear wavy boundary.

B2-18 to 26 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; 5 percent pebbles; neutral; clear wavy boundary.

C1-26 to 36 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) moist; many fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common very fine and fine pores; 10 percent pebbles; neutral; clear wavy boundary.

C2-36 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; many fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common very fine pores; few thick lenses of coarse sand; 10 percent pebbles; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Content of pebbles ranges from 0 to 15 percent in the control section. Reaction is neutral or slightly acid. The mollic epipedon is 20 inches or more in thickness.

The A1 horizon has value of 4 or 5, dry and chroma of 1 or 2, dry or moist.

The B2 horizon has value of 4 or 5, dry. It is loam, fine sandy loam, or sandy loam.

The C horizon has value of 3 through 5, moist and chroma of 3 or 4, dry or moist. It is fine sandy loam or sandy loam. Mottles range from few fine faint to many medium distinct.

Newbell series

The Newbell series consists of very deep, well drained soils on foothills. These soils formed in glacial till derived mainly from granite and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 2,500 to 4,500 feet. Average annual precipitation ranges from 18 to 30 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Newbell silt loam, 40 to 65 percent slopes; about 8 miles south of Kettle Falls, 1,800 feet south, and 400 feet west of the northeast corner of sec. 20, T. 35 N., R. 38 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, twigs, bark, and cones; slightly acid; abrupt smooth boundary.

A2-0 to 1/4 inch; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B21-1/4 inch to 10 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; few fine pores; 5 percent pebbles; slightly acid; abrupt smooth boundary.

B22-10 to 13 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; few fine pores; 10 percent pebbles; slightly acid; clear wavy boundary.

IIC1-13 to 27 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; few fine and medium distinct mottles, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; slightly sticky and slightly plastic; common fine and medium and few coarse roots; few fine pores; 35 percent pebbles; slightly acid; clear wavy boundary.

IIC2-27 to 36 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; few fine and medium distinct mottles, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; few fine pores; 45 percent pebbles; slightly acid; clear wavy boundary.

IIC3-36 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; common fine and medium distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; common medium and few coarse roots; few fine pores; 50 percent pebbles; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. The soils are generally moist but are dry between a depth of 8 and 24 incises for 60 to 75 consecutive days following the summer solstice. Content of pebbles in the control section ranges from 35 to 60 percent. Reaction is neutral or slightly acid. Some pedons are stony on the surface. The mantle of volcanic ash and loess ranges from 7 to 13 inches in thickness and is less than 60 percent pyroclastic material.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The B2 horizon has hue of 10YR or 7.5YR; value of 6 or 7, dry and 4 or 5, moist; and chroma of 3 or 4, dry or moist. It is silt loam or loam. Content of pebbles ranges from 5 to 15 percent.

The IIC horizon has hue of 2.5Y or 10YR; value of 4 through 6, moist; and chroma of 2 through 4, dry or moist. It is loam or sandy loam. Content of rock fragments ranges from 35 to 60 percent.

Peone series

The Peone series consists of very deep, poorly drained soils on alluvial fans, flood plains, and in depressional areas. These soils formed in volcanic ash, diatomite, and mixed alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,700 to 2,500 feet. Average annual precipitation ranges from 13 to 22 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Peone silt loam; about 5 miles south of Springdale, 2,000 feet west and 300 feet north of the southeast corner of sec. 26, T. 29 N., R. 40 E., of the Willamette meridian:

A1p-0 to 6 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many fine roots; many *very* fine pores; neutral; abrupt smooth boundary.

A12g-6 to 14 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; few dark brown (10YR 3/3) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; many fine roots; many very fine pores; neutral; abrupt smooth boundary.

C1g-14 to 32 inches; white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) moist; many fine and distinct dark brown (10YR 3/3) mottles; massive to weak thick platy structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; many fine roots; many very fine pores; neutral; clear wavy boundary.

C2g-32 to 38 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; few distinct dark brown (10YR 3/3) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; many very fine pores; neutral; clear wavy boundary.

C3g-38 to 43 inches; light gray (10YR 7/2) silt loam, olive gray (5Y 5/2) moist; many fine and medium distinct dark brown (7.5YR 4/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; neutral; clear wavy boundary.

Cog-43 to 60 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; many fine and medium dark brown (7.5YR 4/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. The control section is more than 60 percent volcanic ash. Reaction is slightly acid or neutral.

The A horizon has value of 2 through 4, moist and 5 or 6, dry and chroma of 1 or 2, dry or moist.

The C horizon has hue of 10YR, 2.5Y, or 5Y and chroma of 1 or 2, dry or moist. It is silt loam, sandy loam, or very fine sandy loam.

Phoebe series

The Phoebe series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in sandy glacial outwash, with an admixture of volcanic ash and loess. Slope ranges from 0 to 15 percent. Elevation ranges from 1,800 to 2,500 feet. Average annual precipitation ranges from 16 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 120 to 140 days.

Typical pedon of Phoebe sandy loam, 0 to 5 percent slopes; about 2 1/2 miles southeast of Wellpinit, 600 feet north, and 1,300 feet west of the southeast corner of sec. 10, T. 27 N., R. 38 E., of the Willamette meridian:

A1p-0 to 6 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; slightly acid; abrupt smooth boundary.

A12-6 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; slightly acid; clear wavy boundary.

B2-12 to 21 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; neutral; clear wavy boundary.

C1-21 to 36 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and slightly plastic; common fine roots; many very fine pores; 5 percent pebbles; neutral; clear wavy boundary.

C2-36 to 54 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine pores; 5 percent pebbles; neutral; clear wavy boundary.

C3-54 to 60 inches; very pale brown (10YR 7/4) sand, yellowish brown (10YR 5/4) moist; single grain; loose, few fine roots; few very fine pores; 5 percent pebbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Reaction is slightly acid or neutral. The mollic epipedon ranges from 14 to 20 inches in thickness.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 or 2, dry or moist.

The B horizon has value of 4 through 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is sandy loam or fine sandy loam.

The C horizon has value of 5 through 7, dry and 3 through 5, moist and chroma of 3 or 4, dry or moist. It is sandy loam, loamy sand, or sand. Content of rock fragments ranges from 5 to 15 percent.

Raisio series

The Raisio series consists of moderately deep, well drained soils on foot slopes, side slopes, and ridgetops of mountains. These soils formed in residuum derived from shaly rock, modified in places by glacial till and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 1,800 to 4,500 feet. Average annual precipitation ranges from 20 to 30 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Raisio shaly loam, 40 to 65 percent slopes; about 2 miles southeast of Gifford, 900 feet south, and 150 feet east of the northwest corner of sec. 4, T. 33 N., R. 38 E., of the Willamette meridian:

O1-1 1/2 inches to 0; loose organic litter, including ponderosa pine needles, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 5 inches; grayish brown (10YR 5/2) shaly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; 20 percent shaly fragments; neutral; clear wavy boundary.

B2-5 to 9 inches; brown (10YR 5/3) very flaggy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; 25 percent shaly fragments and 25 percent flagstones; neutral; clear wavy boundary.

C1-9 to 18 inches; light brownish gray (10YR 6/2) extremely flaggy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; 25 percent shaly fragments and 40 percent flagstones; neutral; clear wavy boundary.

C2-18 to 26 inches; light gray (2.5Y 7/2) extremely flaggy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; 25 percent shaly fragments and 50 percent flagstones; slightly acid; clear wavy boundary.

C3-26 to 30 inches; light gray (2.5Y 7.2) extremely flaggy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; 65 percent shaly fragments; slightly acid; abrupt wavy boundary.

R-30 inches; phyllite.

Depth to a lithic contact ranges from 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 48° to 50° F. Content of shaly fragments and flagstones in the control section ranges from 35 to 80 percent. Reaction is slightly acid or neutral throughout.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, moist or dry. Content of shaly fragments ranges from 15 to 25 percent.

The B2 horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 2 or 3, moist or dry. Content of shaly fragments ranges from 20 to 30 percent and flagstones, 20 to 30 percent.

The C horizon has value of 3 through 5, moist and chroma of 1 through 3, dry or moist. Content of shaly fragments ranges from 20 to 30 percent and content of flagstones, from 30 to 50 percent.

Rathdrum series

The Rathdrum series consists of very deep, well drained soils on terraces in depressional areas. These soils formed in alluvium from volcanic ash and loess and are underlain by glacial outwash material. Slope ranges from 0 to 3 percent. Elevation ranges from 1,600 to 3,500 feet. Average annual precipitation ranges from 22 to 32 inches, and average annual air temperature is 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Rathdrum silt loam, 2,600 feet east and 500 feet south of the northwest corner of sec. 17. T. 31 N., R. 41 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; very dark grayish brown (10YR 3/2) loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.
A2-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) moist; massive; soft, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.
B21ir-1/4 inch to 6 inches; very pale brown (10YR 7/3) silt loam, dark brown (10YR 4/3) moist; few fine faint mottles, dark brown (7.5YR 4/4) moist; weak coarse granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; many fine pores; neutral; clear wavy boundary.
B22ir-6 to 14 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; common fine faint mottles, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine roots; many fine pores; neutral; clear wavy boundary.
C1-14 to 30 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; many medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; many fine roots; many fine pores; neutral; clear wavy boundary.
C2-30 to 40 inches; light gray (10YR 7/2) very fine sandy loam, pale brown (10YR 6/3) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; soft, very friable, slightly sticky and nonplastic; many fine roots; few fine pores; neutral; clear wavy boundary.
C3-40 to 60 inches; light gray (10YR 7/2) very fine sandy loam, pale brown (10YR 6/3) moist; common fine distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine pores; neutral.

The control section is more than 60 percent pyroclastic material. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F.

The A2 horizon is intermittent and ranges from about 1/4 to 1/2 inch in thickness.

The Bir horizon has hue of 10YR or 7.5YR and value of 3 through 5, moist and 6 or 7, dry.

The C horizon has value of 5 or 6, moist and 6 or 7, dry. It is very fine sandy loam or silt loam.

Republic series

The Republic series consists of very deep; well drained soils on alluvial fans and terraces, toe slopes, and foot slopes of foothills. These soils formed in alluvium and glacial till, with an admixture of loess and volcanic ash. Slope ranges from 0 to 40 percent. Elevation ranges from 1,600 to 3,500 feet. Average annual precipitation ranges from 15 to 18 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 95 to 110 days.

Typical pedon of Republic silt loam, 0 to 8 percent slopes; about 1 mile west of Hunters, 1,000 feet south, and 1,000 feet west of the northeast corner of sec. 12, T. 30 N., R. 36 E., of the Willamette meridian:

Ap-0 to 100 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; 10 percent pebbles; slightly acid; abrupt smooth boundary.
A3-10 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; 10 percent pebbles; neutral; clear wavy boundary.
B2-18 to 31 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; 25 percent pebbles; neutral; clear wavy boundary.
C1-31 to 38 inches; light yellowish brown (10YR 6/4) gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; 25 percent pebbles; neutral; clear wavy boundary.
C2-38 to 60 inches; pale yellow (2.5Y 7/4) gravelly sandy loam, light olive brown (2.5Y 5/4) moist; thin and medium platy structure; hard, firm, slightly sticky and slightly plastic; few fine roots; few very fine pores; 30 percent pebbles; strong effervescence; moderately alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of rock fragments in the control section ranges from 5 to 30 percent. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 1 through 3, dry or moist. It is sandy loam or silt loam. Content of pebbles ranges from 5 to 20 percent. Reaction is slightly acid or neutral.

The B horizon has value of 4 through 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is silt loam, loam, or sandy loam. Content of pebbles ranges from 15 to 30 percent.

The C horizon has value of 5 through 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 20 to 35 percent. Reaction ranges from neutral to moderately alkaline.

Rufus series

The Rufus series consists of shallow, well drained soils on side slopes and ridgetops of mountains. These soils formed in residuum and colluvium derived from shale, with an admixture of volcanic ash and loess. Slope ranges from 30 to 65 percent. Elevation ranges from 1,800 to 4,000 feet. Average annual precipitation ranges from 18 to 30 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 90 to 120 days.

Typical pedon of Rufus shaly loam, 30 to 65 percent slopes; 1,200 feet east and 2,000 feet north of the southwest corner of sec. 7, T. 32 N., R. 38 E., of the Willamette meridian:

A11-0 to 4 inches; grayish brown (10YR 5/2) shaly loam, very dark grayish brown (10YR 3/2; moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; 30 percent shaly fragments; neutral; clear wavy boundary.

A12-4 to 8 inches; brown (10YR 5/3) very flaggy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine pores; 25 percent shaly fragments and 25 percent flagstones; neutral; abrupt irregular boundary.

AC-8 to 14 inches; grayish brown (10YR 5/2) extremely flaggy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; 65 percent hard phyllite fragments and flagstones; slightly acid; abrupt irregular boundary.

R-14 inches; phyllite.

Depth to a lithic contact ranges from 10 to 20 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 50° F. Content of shaly fragments and flagstones in the control section ranges from 35 to 80 percent.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of shaly fragments and flagstones ranges from 25 to 35 percent. The AC horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry and 3 through 5, moist; and chroma of 2 or 3, moist or dry. Content of shaly fragments ranges from 20 to 35 percent and content of flagstones, from 20 to 30 percent. Reaction is slightly acid or neutral.

Saltese series

The Saltese series consists of very deep, very poorly drained organic soils in basins and potholes and on bottom lands. These soils formed in decomposed remains of reeds, sedges, and other plant material, with an admixture of alluvium, diatomite, and volcanic ash. Slope ranges from 0 to 2 percent. Elevation ranges from 2,000 to 2,500 feet. Average annual precipitation ranges from 18 to 22 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 110 days.

Typical pedon of Saltese muck; about 1/4 mile east of Deer Lake, 400 feet west, and 900 feet south of the northeast corner of sec. 1, T. 30 N., R. 41 E., of the Willamette meridian:

Oa1-0 to 5 inches; dark reddish brown (5YR 2/2) sapric material, dark reddish brown (5YR 3/2) dry; about 20 percent fiber, less than 5 percent rubbed; weak thin platy parting to weak fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; medium acid; gradual wavy boundary.

Oa2-5 to 10 inches; dark reddish brown (5YR 3/2) sapric material, gray (5YR 6/1) dry; about 45 percent fiber, less than 5 percent rubbed; weak thin platy structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; medium acid; gradual *wavy* boundary.

Oa3-10 to 25 inches; dark reddish brown (5YR 3/2) sapric material, gray (5YR 6/1) dry; about 65 percent fiber, less than 10 percent rubbed; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; medium acid; gradual wavy boundary.

Oa4-25 to 42 inches; dark reddish brown (5YR 2/2) sapric material, gray (5YR 5/1) dry; about 65 percent fiber, less than 10 percent rubbed; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; 1 inch layer of brown (10YR 5/3) moist volcanic ash; medium acid; gradual wavy boundary.

Oa5-42 to 60 inches; olive brown (2.5Y 4/4) sapric material, light gray (10YR 7/1) dry; about 70 percent fiber, less than 10 percent rubbed; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Content of unrubbed fiber for all tiers ranges from 5 to 75 percent and of rubbed fiber, 1 to 10 percent. Thin discontinuous layers of volcanic ash or diatomaceous earth can occur at any depth. Reaction is medium acid or slightly acid.

Scoap series

The Scoap series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till and colluvium, with an admixture of loess and volcanic ash. Slope ranges from 5 to 65 percent. Elevation ranges from 1,500 to 3,000 feet. Average annual precipitation ranges from 18 to 22 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Scoap gravelly loam, 40 to 65 percent slopes; about 3 miles southeast of Gifford, 1,400 feet south, and 2,300 feet east of the northwest corner of sec. 12, T. 32 N., R. 37 E., of the Willamette meridian:

O1&O2-2 inches to 0; black (10YR 2/1) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; slightly acid; abrupt smooth boundary.

A11-0 to 7 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 25 percent pebbles; neutral; clear wavy boundary.

A12-7 to 13 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 25 percent pebbles; slightly acid; clear wavy boundary.

B21-13 to 26 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 25 percent pebbles; slightly acid; clear wavy boundary.

B22-26 to 33 inches; pale brown (10YR 6/3) very cobbly loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 20 percent pebbles and 25 percent cobbles; slightly acid; clear wavy boundary.

B3-33 to 43 inches; light yellowish brown (10YR 6/4) very cobbly loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 20 percent pebbles and 30 percent cobbles; slightly acid; clear wavy boundary.

C-43 to 60 inches; very pale brown (10YR 7/4) very stony loam, dark brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; 10 percent pebbles, 15 percent cobbles, and 25 percent stones; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of clay in the control section is less than 18 percent, and content of rock fragments ranges from 35 to 50 percent. Reaction is neutral or slightly acid throughout the profile

The A1 horizon has chroma of 1 or 2, moist or dry. Content of pebbles ranges from 15 to 30 percent.

The B horizon has value of 3 or 4, moist. It is loam or silt loam. Content of pebbles ranges from 20 to 30 percent and cobbles, 0 to 30 percent. Content of rock fragments is more than 35 percent.

The C horizon has value of 5 through 7, dry and 3 or 4, moist. Content of pebbles ranges from 10 to 20 percent and cobbles and stones, 25 to 40 percent.

Scrabblers series

The Scrabblers series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in sandy glacial outwash derived mainly from granitic rock and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 2,200 to 4,500 feet. Average annual precipitation ranges from 20 to 35 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Scrabblers very fine sandy loam, 0 to 20 percent slopes; 2,600 feet south and 1,500 feet west of the northeast corner of sec. 1, T. 35 N., R. 41 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

B21ir-0 to 6 inches; pale brown (10YR 6/3) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium and few coarse roots; many fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B22ir-6 to 11 inches; light yellowish brown (10YR 6/4) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium and few coarse roots; many fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

IIB3-11 to 19 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common medium and coarse pores; 10 percent pebbles; neutral; clear wavy boundary.

IIC1-19 to 28 inches; very pale brown (10YR 8/3) gravelly loamy sand, light yellowish brown (2.5Y 6/4) moist; massive; loose, very friable, nonsticky and nonplastic; few medium and coarse roots; few coarse pores; 15 percent pebbles; neutral; clear wavy boundary.

IIC2-28 to 60 inches; pale yellow (5Y 8/3) gravelly loamy sand, light yellowish brown (2.5Y 6/4) moist; massive; loose; few medium and coarse roots; few coarse pores; 20 percent pebbles; neutral; gradual wavy boundary.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. The weighted average of rock fragments in the control section is less than 35 percent. Reaction is slightly acid or neutral.

The B2ir horizon has value of 6 or 7, dry and 3 through 5, moist. Content of pebbles ranges from 0 to 10 percent. The B3 horizon has hue of 10YR or 2.5Y; value of 7 or 8, dry and 5 or 6, moist; and chroma of 3 or 4, dry or moist. It is sandy loam or loamy sand. Content of pebbles ranges from 5 to 10 percent.

The C horizon has hue of 10YR, 2.5Y, or 5Y and value of 7 or 8, dry and 5 or 6, moist. Content of pebbles ranges from 10 to 25 percent.

Skanid series

The Skanid series consists of shallow, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of mountains. These soils formed in residuum derived from granite, with an admixture of loess and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 1,800 to 3,000 feet. Average annual precipitation ranges from 18 to 30 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Skanid loam, 25 to 40 percent slopes; about 2 miles east of Long Lake Dam, 1,200 feet south, and 1,400 feet west of the northeast corner of sec. 16, T. 27 N., R. 40 E., of the Willamette meridian:

A11-0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many fine roots; many fine pores; 10 percent pebbles; neutral; clear wavy boundary.

A12-6 to 10 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common fine pores; 20 percent pebbles; neutral; clear wavy boundary.

C1-10 to 15 inches; pale brown (10YR 6/3) very gravelly coarse sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; few fine pores; 40 percent pebbles; neutral; abrupt *wavy* boundary.

C2r-15 inches; weathered granite.

Depth to a paralithic contact ranges from 10 to 20 inches. Mean annual soil temperature ranges from 47° to 52° F. Content of pebbles ranges from 10 to 55 percent, but the weighted average is more than 35 percent in the control section. Reaction is slightly acid or neutral.

The A horizon has value of 4 or 5, dry and 2 or 3, moist. Content of pebbles ranges from 10 to 30 percent.

The C horizon has value of 5 or 6, dry and 3 or 4, moist. It is loam, sandy loam, or coarse sandy loam. Content of pebbles ranges from 35 to 55 percent.

Smackout series

The Smackout series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in glacial till derived mainly from shale and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 2,000 to 3,500 feet. Average annual precipitation ranges from 22 to 32 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Smackout loam, 40 to 65 percent slopes; about one mile southwest of Cedar Lake, 1,500 feet north, and 1,000 feet east of the southwest corner of sec. 34, T. 40 N., R. 41 E., of the Willamette meridian:

O1&O2-1 1/2 inches to 0; partially decomposed mat of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

B21ir-0 to 7 inches; light yellowish brown (10YR 6/4) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine pores; 5 percent pebbles; neutral; clear wavy boundary.

B22ir-7 to 12 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine pores; 10 percent pebbles; neutral; abrupt smooth boundary.

IIB23-12 to 25 inches; light brownish gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 15 percent pebbles; neutral; clear wavy boundary.

IIB24-25 to 34 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium and few coarse roots; common fine pores; 20 percent pebbles; neutral; clear wavy boundary.

IIB3-34 to 48 inches; gray (5Y 5/1) gravelly sandy clay loam, very dark gray (5Y 3/1) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common fine pores; 25 percent pebbles; neutral; clear wavy boundary.

IIC-48 to 60 inches; gray (5Y 5/1) gravelly loam, very dark gray (5Y 3/1) moist; massive; hard, firm, sticky and plastic; few fine, medium, and coarse roots; few fine pores; 30 percent pebbles; mildly alkaline.

Content of clay in the control section ranges from 20 to 30 percent. Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Reaction is neutral or mildly alkaline throughout the profile.

The B horizon has hue of 10YR or 7.5YR and value of 6 or 7, dry and 3 or 4, moist. Content of pebbles ranges from 0 to 10 percent.

The IIB and IIC horizons have hue of 10YR, 2.5Y, or 5Y and value of 5 through 7, dry. They are loam, sandy clay loam, clay loam, or silty clay loam. Content of pebbles ranges from 15 to 30 percent and cobbles, 0 to 5 percent.

Spens series

The Spens series consists of very deep, somewhat excessively drained soils on terrace escarpments of major drainageways. These soils formed in mixed glacial outwash and colluvial material. Slope ranges from 25 to 65 percent. Elevation ranges from 1,400 to 2,100 feet. Average annual precipitation ranges from 17 to 20 inches, and average annual air temperature k; about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Spens extremely gravelly loamy sand, 30 to 65 percent slopes; about 2 miles east of Long Lake Dam, 2,400 feet south, and 1,600 feet west of the northeast corner of sec. 16, T. 27 N., R. 40 E., of the Willamette meridian:

A1-0 to 7 inches; grayish brown (10YR 5/2) extremely gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, friable, nonsticky and nonplastic; many fine and medium roots; 65 percent pebbles; neutral; clear wavy boundary.

C1-7 to 17 inches; brown (10YR 5/3) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 3/4) moist; single grain; loose; common fine roots; 55 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

C2-17 to 60 inches; brown (10YR 5/3) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 3/4) moist; single grain; loose; few fine roots; 65 percent pebbles and 10 percent cobbles; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51 ° F. Content of pebbles in the control section ranges from 55 to 70 percent and cobbles, 5 to 10 percent. Reaction is slightly acid or neutral.

The A horizon has value of 5 or 6, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of pebbles and cobbles ranges from 60 to 75 percent and content of stones, from 0 to 10 percent.

The C horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loamy sand or loamy coarse sand. Content of pebbles and cobbles ranges from 60 to 80 percent.

Spokane series

The Spokane series consists of moderately deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of mountains. These soils formed in material weathered from granite, with an admixture of loess and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 1,800 to 3,000 feet. Average annual precipitation ranges from 16 to 23 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Spokane loam, 25 to 40 percent slopes; about 6 miles northwest of Wellpinit, 600 feet south, and 1,400 feet west of the northeast corner of sec. 23, T. 28 N., R. 37 E., of the Willamette meridian:

O1&O2-1 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of pine needles, leaves, twigs, and cones; neutral; abrupt smooth boundary.

A1-0 to 9 inches: grayish brown (10YR 5/2) loam, very dark grayish b, own (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; slightly acid; 10 percent pebbles; gradual wavy boundary.

B2-9 to 16 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; 20 percent pebbles; neutral; clear wavy boundary.

C1-16 to 26 inches; very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 5/3) moist; few fine distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common roots; many fine pores; 20 percent pebbles; neutral; clear wavy boundary.

C2r-26 inches; pale brown, light gray, and gray (10YR 6/3, 7/2, and 5/1) weathered granite; neutral.

The depth to weathered granite is 20 to 40 inches, and the depth to hard rock is 40 to more than 60 inches. The mean annual soil temperature at 20 inches is 47° to 50° F. Content of rock fragments in the control section ranges from 15 to 35 percent. Reaction is neutral or slightly acid. The mollic epipedon ranges from 7 to 12 inches in thickness.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of pebbles ranges from 5 to 15 percent and content of stones, from 0 to 10 percent.

The B2 horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 15 to 25 percent.

The C horizon has value of 5 through 7, dry and 4 or 5, moist and chroma of 2 through 4, dry or moist. It is sandy loam or coarse sandy loam. Content of pebbles ranges from 15 to 35 percent.

Springdale series

The Springdale series consists of very deep, somewhat excessively drained soils on terraces. These soils formed in glacial outwash, with an admixture of volcanic ash and loess. Slope ranges from 0 to 15 percent. Elevation ranges from 1,400 to 2,300 feet. Average annual precipitation ranges from 16 to 23 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Springdale gravelly sandy loam, 0 to 15 percent slopes; about 3 miles south of Tum Tum, 2,700 feet south, and 650 feet west of the northeast corner of sec. 11, T. 27 N., R. 40 E., of the Willamette meridian:

O1&O2-1/2 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of ponderosa pine needles, leaves, twigs, bark, and cones; slightly acid; abrupt smooth boundary.

A1-0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine, medium, and coarse pores; 20 percent pebbles; slightly acid; clear wavy boundary.

C1-4 to 11 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine, medium, and coarse pores; 25 percent pebbles, 3 percent cobbles, 2 percent stones; slightly acid; clear wavy boundary.

C2-11 to 21 inches; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; loose; very friable, nonsticky and nonplastic; common medium and coarse roots; common medium and coarse pores; 40 percent pebbles, 10 percent cobbles, 2 percent stones; neutral; clear wavy boundary.

C3-21 to 60 inches; multicolored extremely cobbly coarse sand; single grain; loose; few coarse roots; few coarse pores; 35 percent pebbles, 25 percent cobbles, 5 percent stones; neutral.

Depth to coarse sand, gravel, cobbles, and stones is 20 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Content of rock fragments in the control section ranges from 35 to 60 percent. Reaction is neutral or slightly acid.

The A1 horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, dry or moist. Content of pebbles ranges from 10 to 30 percent. Content of cobbles ranges from 0 to 25 percent.

The C1 horizon has value of 5 or 6, dry and 3 or 4, moist. It is sandy loam or coarse sandy loam. Content of pebbles and cobbles ranges from 25 to 50 percent.

The C2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 3 or 4, dry or moist. It is coarse sandy loam to loamy coarse sand. Content of pebbles, cobbles, and stones ranges from 45 to 60 percent. Content of pebbles, cobbles, and stones in the C3 horizon ranges from 55 to 70 percent. The C3 horizon is loamy coarse sand to coarse sand.

Stevens series

The Stevens series consists of very deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of foothills. These soils formed in mixed glacial till, with an admixture of loess and volcanic ash. Slope ranges from 0 to 65 percent. Elevation ranges from 1,700 to 3,000 feet. Average annual precipitation ranges from 17 to 20 inches, and average annual air temperature is about 47° F. The frost-free season ranges from 110 to 130 days.

Typical pedon of Stevens silt loam, 8 to 15 percent slopes; about 2 miles northeast of Barstow, 400 feet east, and 500 feet north of the southwest corner of sec. 11, T. 38 N., R. 37 E., of the Willamette meridian:

Ap-0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; 5 percent pebbles; neutral; abrupt smooth boundary.

A12-8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few fine pores; 5 percent pebbles; neutral; clear wavy boundary.

A13-15 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; 10 percent pebbles; neutral; gradual wavy boundary.

B2-19 to 30 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; 15 percent pebbles; thin patchy clay films on faces of peds and in pores; neutral; gradual wavy boundary.

B3-30 to 38 inches; grayish brown (2.5Y 5/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; 30 percent pebbles;

thin patchy clay films on faces of peds and in pores; neutral; gradual wavy boundary.

C1-38 to 60 inches; grayish brown (2.5Y 5/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few roots; many fine pores; 30 percent pebbles; slight effervescence; mildly alkaline.

Depth to carbonates ranges from 25 to 40 inches. Mean annual soil temperature at a depth of 20 inches ranges from 47° to 52° F. Content of coarse fragments in the control section ranges from 5 to 30 percent. The mollic epipedon ranges from 20 to 30 inches in thickness.

The A horizon has value of 4 or 5, dry and 2 or 3, moist. Content of coarse fragments ranges from 0 to 25 percent. Some pedons are stony on the surface.

The B horizon has value of 4 through 6, dry and chroma of 2 through 4, dry or moist. It is silt loam or loam. Content of coarse fragments ranges from 15 to 30 percent.

The C horizon has hue of 10YR or 2.5Y; value of 4 through 6, dry and 3 or 4, moist; and chroma of 2 through 4, dry or moist. It is loam or sandy loam. Content of coarse fragments ranges from 15 to 35 percent. Reaction is neutral or mildly alkaline.

Thout series

The Thout series consists of moderately deep, well drained soils on toe slopes, foot slopes, side slopes, and ridgetops of foothills. These soils formed in residuum, colluvium, and glacial till, with an admixture of volcanic ash. Slope ranges from 8 to 65 percent. Elevation ranges from 2,200 to 4,500 feet. Average annual precipitation ranges from 20 to 35 inches, and average annual air temperature is about 43° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Thout gravelly loam, 40 to 65 percent slopes; about 4 miles east of Pierre Lake, 1,300 feet north, and 2,600 feet west of the southeast corner of sec. 4, T. 39 N., R. 37 E., of the Willamette meridian:

O1&O2-2 inches to 0; very dark brown (10YR 2/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A1-0 to 5 inches; grayish brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; Tweak very fine and fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine, common medium and coarse roots; many fine pores; 15 percent pebbles; neutral; clear wavy boundary.

A3-5 to 9 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; weak very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many fine pores; 25 percent pebbles; neutral; clear wavy boundary.

B2-9 to 16 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many fine pores; 25 percent angular pebbles, 10 percent angular cobbles; neutral; clear wavy boundary.

C1-16 to 24 inches; yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 3/4), moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine pores; 35 percent angular pebbles, 15 percent angular cobbles; neutral; abrupt irregular boundary.

R-24 inches; andesite.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F. Content of pebbles and cobbles in the control section ranges from 35 to 50 percent. Depth to a lithic contact ranges from 20 to 40 inches.

Content of pebbles in the A horizon ranges from 15 to 25 percent.

The B2 horizon has value of 5 or 6, dry and 3 or 4, moist. Content of rock fragments ranges from 35 to 50 percent.

The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. Content of pebbles ranges from 25 to 35 percent and content of cobbles, from 10 to 15 percent.

Vassar series

The Vassar series consists of deep, well drained soils on side slopes of mountains. These soils formed in colluvium and residuum derived from granite, gneiss, or other micaceous rocks and are mantled with volcanic ash and loess. Slope ranges from 30 to 65 percent. Elevation ranges from 3,000 to 5,400 feet. Average annual precipitation ranges from 30 to 45 inches, and average annual air temperature is about 40° F. The frost-free season ranges from 70 to 90 days.

Typical pedon of Vassar silt loam, 30 to 65 percent slopes; about 5 miles northeast of Deer Lake, 2,000 feet west, and 2,400 feet south of the northeast corner of sec. 9, T. 31 N., R. 42 E., of the Willamette meridian:

O1-2 inches to 1 inch; relatively fresh needles, cones, bark, and twigs.

O2-1 inch to 0; partially decomposed needles, cones, bark, and twigs.

A2-0 to 1/2 inch; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots; medium acid; abrupt smooth boundary.

B21ir-1/2 inch to 9 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium roots, few coarse roots; common fine pores; neutral; 2 percent pebbles; clear wavy boundary.

B22ir-9 to 20 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/4) moist; weak, fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium roots, few coarse roots; many fine pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B23ir-20 to 30 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots, few coarse roots; common fine pores; 8 percent pebbles; slightly acid; clear wavy boundary.

IIC1-30 to 40 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine pores; 20 percent pebbles; slightly acid; clear wavy boundary.

IIC2-40 to 48 inches; light yellowish brown (2.5Y 6/4) gravelly sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; 25 percent pebbles; slightly acid; gradual wavy boundary.

IIC3-48 to 54 inches; light yellowish brown (2.5Y 6/4) gravelly sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; 30 percent pebbles; slightly acid; clear wavy boundary.

IIC4r-54 inches; weathered granite.

The upper part of the control section is less than 60 percent volcanic ash. Mean annual soil temperature at a depth of 20 inches ranges from 40° to 42° F. Depth to weathered bedrock ranges from 40 to 60 inches.

If the soils are undisturbed, the A2 horizon is light gray or light brownish gray (10YR 7/1, 7/2) and ranges from 0.1 to 0.5 inch in thickness. If the soils are disturbed, the A2 horizon is not present.

The B2ir horizon has value of 4 through 6, dry. It is loam or silt loam. Content of rock fragments ranges from 0 to 15 percent.

The IIC horizon has value of 5 or 6, dry and 3 or 4, moist and chroma of 3 or 4, dry or moist. It is sandy loam to loamy coarse sand. Content of rock fragments ranges from 20 to 30 percent. Reaction is slightly acid or medium acid.

Waits series

The Waits series consists of very deep, well drained soils on toe slopes, foot slopes, and side slopes of foothills. These soils formed in calcareous glacial till and are mantled with volcanic ash and loess. Slope ranges from 0 to 65 percent. Elevation ranges from 2,100 to 4,000 feet. Average annual precipitation ranges from 20 to 30 inches, and average annual air temperature is about 44° F. The frost-free season ranges from 90 to 110 days.

Typical pedon of Waits loam, 40 to 65 percent slopes; 1,300 feet north and 1,300 feet east of the southwest corner of sec. 20, T. 36 N., R. 40 E., of the Willamette meridian:

O2-1 1/2 inches to 0; loose, partially decomposed organic litter of needles, leaves, and twigs; slightly acid; abrupt smooth boundary.

A2-0 to 1/2 inch; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; neutral; abrupt wavy boundary.

B21ir-1/2 inch to 7 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium, few coarse roots; many fine pores; 5 percent pebbles; neutral; clear wavy boundary.

B22ir-7 to 17 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; 10 percent pebbles; neutral; clear wavy boundary.

IIB3-17 to 23 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; 15 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC1-23 to 36 inches; light gray (2.5Y 7/2) gravelly loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; 20 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2-36 to 60 inches; light gray (2.5Y 7/2) gravelly loam, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; 25 percent pebbles; strong effervescence; moderately alkaline.

Mean annual soil temperature at a depth of 20 inches ranges from 45° to 47° F.

The A2 horizon has value of 6 or 7, dry and 4 or 5, moist and chroma of 1 or 2, dry or moist.

The Bir horizon has hue of 10YR or 7.5YR; value of 5 through 7, dry and 3 or 4, moist; and chroma of 3 or 4, dry or moist. It is very fine sandy loam, loam, or silt loam.

Reaction is neutral or mildly alkaline. Content of pebbles ranges from 5 to 15 percent and content of cobbles and stones, from 0 to 5 percent.

The IIC horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry and 4 or 5, moist; and chroma of 2 through 4, dry or moist. It is loam or sandy loam. Content of pebbles ranges from 15 to 30 percent and content of cobbles and stones, from 0 to 5 percent. Reaction is mildly alkaline or moderately alkaline.

Wethey series

The Wethey series consists of very deep, somewhat poorly drained soils on bottom lands and alluvial fans and in depressional areas. These soils formed in mixed sandy alluvium. Slope ranges from 0 to 3 percent. Elevation ranges from 1,500 to 2,300 feet. Average annual precipitation ranges from 16 to 22 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Wethey loamy sand; east of the Kettle River, 4,100 feet west, and 400 feet south of the northeast corner of sec. 4, T. 37 N., R. 37 E., of the Willamette meridian:

A11-0 to 13 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; few fine distinct mottles, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, friable, nonsticky and nonplastic; common fine roots; few fine pores; slightly acid; clear wavy boundary.

A12-13 to 28 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; few fine faint mottles, dark brown (10YR 3/3) moist; massive; soft, friable, nonsticky and nonplastic; common fine roots; few fine pores; neutral; clear wavy boundary.

C1-28 to 40 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; common fine and medium distinct mottles, grayish brown (10YR 5/2) moist; massive; soft, friable, nonsticky and nonplastic; few fine roots; few fine pores; slightly acid; clear wavy boundary.

C2-40 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; massive; common fine and medium distinct mottles, grayish brown (10YR 5/2) moist; massive; soft, friable, nonsticky and nonplastic; few fine roots; few fine pores; neutral.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 51° F. Reaction is neutral or slightly acid.

The A horizon has value of 4 or 5, dry and 2 or 3, moist and chroma of 2 or 3, moist or dry. The C horizon is loamy fine sand or loamy sand.

Wolfeson series

The Wolfeson series consists of very deep, somewhat poorly drained soils in depressional areas on terraces. These soils formed in mixed glaciofluvial material, with an admixture of loess and volcanic ash. Slope ranges from 0 to 3 percent. Elevation ranges from 1,700 to 2,500 feet. Average annual precipitation ranges from 20 to 24 inches, and average annual air temperature is about 46° F. The frost-free season ranges from 100 to 120 days.

Typical pedon of Wolfeson very fine sandy loam, about 1.5 miles northwest of Clayton, 200 feet east and 2,600 feet south of the northwest corner of sec. 13, T. 29 N., R. 41 E., of the Willamette meridian:

O1-1 1/2 inch to 0; very dark grayish brown (10YR 3/2) moist, loose, partially decomposed organic litter of needles, leaves, twigs, and cones; medium acid; abrupt smooth boundary.

A2-0 to 1/2 inch; white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; nonsticky and nonplastic; many fine roots; many fine pores; slightly acid; abrupt smooth boundary.

B21-1/2 inch to 15 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly acid; gradual wavy boundary.

B22-15 to 23 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; few fine and medium mottles, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; slightly acid; abrupt smooth boundary.

IlC1-23 to 33 inches; light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4.4) moist; common fine and medium mottles, dark brown (7.5YR 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; common very fine pores; slightly acid; gradual wavy boundary.

IIIC2-33 to 53 inches; light brownish gray (2.5Y 6/2) sandy loam, olive brown (2.5Y 4/4) moist; common fine and medium distinct mottles, dark brown (7.5Y 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; common very fine pores; slightly acid; abrupt smooth boundary.

IVC3-53 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; common very fine pores; slightly acid.

Mean annual soil temperature at a depth of 20 inches ranges from 47° to 49° F. Reaction is slightly acid or neutral.

The B2 horizon has value of 5 through 7, dry and 3 through 5, moist and chroma of 2 through 4, dry or moist. It is very fine sandy loam, loam, or sandy loam. Mottles range from few fine and medium to common fine and medium distinct.

The C horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry and 4 or 5, moist; and chroma of 2 through 5, dry or moist. It is loam, sandy loam, loamy fine sand, or silty clay loam. Mottles range from few fine and medium to many fine and medium distinct.

formation of the soils

This section describes the factors of soil formation and the effects of these factors on the major soils in Stevens County.

factors of soil formation

Properties of soil at any given place are determined by the interaction of five factors. These factors are physical and chemical composition of the parent material, the climate under which the soil-forming material accumulated and existed since accumulation, plant and animal life on and in the soil, the shape and relief of the soil surface, and the length of time the processes of soil formation have acted on the soil material.

parent material

Parent material is that part of the regolith at the earth's surface in which soil develops. The soils in Stevens County formed in parent material such as volcanic ash and loess; glacial drift including till, outwash, and lacustrine sediment; residuum From igneous, metamorphic, and sedimentary bedrock; and recent accumulations of alluvium and organic matter.

Volcanic ash from two major postglacial eruptions in the Cascade Mountains has been deposited over most of Stevens County. The main sources of ash are from the Glacier Peak eruptions in the North Cascades occurring more than 12,000 years ago and the Mount Mazama eruption in the southern Oregon Cascades about 6,600 years ago (7).

Aits and Donavan soils are examples of deep soils that formed in volcanic ash and loess over noncalcareous glacial till on foothills. These soils typically are more than 60 inches deep to bedrock. Bestrom soils formed in similar material and typically are 20 to 40 inches deep to bedrock. This till is of mixed mineralogy. It is slightly acid or neutral and is slightly hard or hard, when dry but friable when moist. Texture ranges from sandy loam to loam or silt loam. Content of clay is less than 18 percent by weight, and content of gravel ranges from 15 to 35 percent by volume.

Merkel and Dehart soils formed in loamy-skeletal glacial till that is mantled with volcanic ash and loess. These soils are on foothills and typically are more than 60 inches deep to bedrock. This till is of mixed mineralogy. It is neutral or slightly acid and is slightly hard or hard when dry but friable when moist Texture ranges from loam to sandy loam or loamy coarse sand. Content of clay is less than 18 percent by weight, and content of rock fragments is more than 35 percent by volume.

Ahren and Waits soils formed in calcareous glacial till that is mantled with volcanic ash and loess. These soils are on foothills and typically are more than 60 inches deep to bedrock. This till is moderately alkaline or strongly alkaline and is hard when dry but friable when moist. The Ahren soils range from loam to clay loam or silty clay loam. Content of clay is more than 18 percent by weight, and content of coarse fragments ranges from 15 to 35 percent by volume.

Smackout soils formed in noncalcareous, fine textured glacial till that is mantled with volcanic ash and loess. These soils are on foothills and generally are more than 60 inches deep to bedrock. This till is of mixed mineralogy. It is neutral or mildly alkaline and is hard when dry but friable when moist. Texture ranges from loam to sandy clay loam or clay loam and silty clay loam. Content of clay is more than 18 percent by weight, and content of coarse fragments ranges from 10 to 35 percent by volume.

Meltwater streams issuing from the melting ice fronts transported, sorted, and deposited glacial material as outwash, kames, and flood plains. These deposits now appear as terraces in primary and secondary drainage channels. Typical examples of glacial outwash are found in the vicinity of Loon, Waits, and Deer Lakes. Generally the surfaces of outwash terraces are nearly level, but some are strongly sloping. The terrace escarpments are steep or very steep. In a few places the terraces exhibit Kettle-Kame topography. The glacial outwash is low in content of clay and silt.

Springdale, Garrison, and Bonners soils formed in glacial outwash material that is mantled with volcanic ash and loess. These soils range from 20 to 40 inches deep to the loose, coarse outwash material. The outwash ranges from loamy sand to sand. Content of gravel ranges from 35 to 60 percent by volume.

Glacial lakes formed where drainageways were temporarily dammed by ice. In these lakes, nongravelly, very fine sand, silt, and clay sediment was deposited. Remnants of these old lake terraces are along Lake Roosevelt, the Kettle River, and the Colville River. In places, glacial lake sediment is covered with a mantle or admixture of volcanic ash and loess.

Soils that formed in glacial lake sediment are very deep and deep, and they have a stratified profile. The stratified sediment ranges from very fine sandy loam and silt loam to clay loam and silty clay loam. Most of the soils that formed in these materials are calcareous at a lower depth. Examples are the Cedonia, Hodgson, Martella, Koerling, and Hunter soils.

Nonglaciated areas are throughout the higher mountainous regions in Stevens County. In these areas, bedrock is weathered to varying degrees and depths. In granitic areas, soil forming material ranges from 10 to more than 40 inches deep to bedrock. This surficial material has been modified by an admixture or a definite mantle of volcanic ash and loess. The amount of volcanic ash and loess ranges from an admixture in Spokane, Mobate, and Skanid soils to a mantle that is more than 14 inches thick on Vassar soils. These soils range from sandy loam and loam to silt loam and are neutral or strongly acid. Content of coarse fragments in the Spokane, Moscow, and Vassar soils is loss than 35 percent by volume. Spokane and Moscow soils range from 20 to 40 inches deep to bedrock, and Vassar soils range from 40 to 60 inches deep. Content of coarse fragments in Skanid and Mobate soils is more than 35 percent by volume, and these soils range from 10 to 20 inches deep to bedrock.

In the shaly rock areas, soil forming material ranges from 10 to 40 inches deep to relatively unweathered bedrock. This material includes either an admixture or a mantle of volcanic ash and loess. Ash and loess range from a modifying influence in the Rufus and Raisio soils to a mantle that is less than 14 inches thick in the Buhrig soils and more than 14 inches thick in the Huckleberry soils. All of these soils range from sandy loam and loam to silt loam and are slightly acid or neutral. Content of coarse fragments ranges from 35 to 90 percent by volume. These soils range from 20 to 40 inches deep to bedrock, with the exception of the Rufus soils, which are 10 to 20 inches deep.

In limestone, calcareous shale, and dolomite areas, soil forming materials range from 20 to 40 inches deep to unweathered bedrock. These soils have either an admixture or a mantle of volcanic ash and loess. Ash and loess range from an admixture in Maki soils to a mantle ranging from 7 to 13 inches in thickness in Belzar soils. Texture of these soils ranges from loam and silt loam to silty clay loam. Reaction ranges from neutral to moderately alkaline. Content of coarse fragments ranges from 25 to 80 percent by volume.

During the Pleistocene epoch, large areas of Stevens County were covered by the Colville lobe of the Cordilleran ice sheet (13). The center of the ice cap was in British Columbia. Direct evidence of ice exists at elevations of more than 5,000 feet in the northern part of the county to about 3,000 feet in the southern part. Residual soil material is in areas that were not covered by ice or inundated by meltwater flooding. These areas are located throughout the county, generally at higher elevations or beyond the ice front. As the ice sheet moved southward, it mixed existing residual soils with material that was carried and reduced by glacial action. This mixture, deposited directly by the ice, is glacial till. The till was exposed as a ground deposit when the ice sheet melted. Obviously, the meltwater had little effect on the till. Most of the till in Stevens County is an unstratified heterogeneous mixture of clay, silt, sand, and gravel, with stones and boulders in places. This material was derived locally from granite, quartzite, andesite, argillite, phyllite, gneiss, schist, dolomite, and limestone. More recent depositions of loess and volcanic ash have accumulated over most of the glaciated and nonglaciated areas.

The predominant parent material along streams and in basins is recent alluvium. This material has been eroded from foothills or mountains and was deposited during periods of overflow. The soils in these areas have a stratified profile, and they range from very poorly drained to moderately well drained. Texture ranges from sand to clay. These soils are more than 60 inches deep. Mineralogy is mixed. Colville and Chewelah soils are alluvial soils that formed in this material.

Organic soils are minor in extent. They formed in wet depressions and in areas adjacent to lakes, where plants that thrive in water have grown. The resulting organic residue is preserved in water. Thin layers of volcanic ash, diatomaceous earth, or alluvium are found in some places. Saltese muck is an organic soil.

Volcanic ash is an important constituent of the upper part of the profile of the soils in Stevens County. Ash gives soils a finer texture and enhances the available water capacity. Volcanic ash is slightly smeary when wet, has a low bulk density, and a low level of fertility (14).

influence of plants, animals, and man

Plants, animals, and micro-organisms determine the rate and character of certain soil forming processes. Plants add organic matter, which decomposes and darkens the color of the mineral surface horizon and promotes granular structure. In addition, plants cycle nutrients through the soil, protect the soil from erosion, and control water movement and loss from soil. Certain micro-organisms and plants form a symbiotic relationship with the soil, taking nitrogen from the air and adding it to the soil in a form that supports biological activity. Different types of plants influence the direction of soil formation as expressed in morphological properties of the A horizon. Grasses annually contribute a considerable quantity of organic material directly to the soil in the form of roots. Residue from leaves and stems is returned to the surface. This relatively large volume of organic matter decomposes throughout the root zone and forms a thick, dark, fertile A horizon. Trees annually deposit a large quantity of litter in the form of leaves, needles, bark, and wood on the soil surface. This litter decomposes slowly through the action of fungi and other micro-organisms. Thus, soils that formed under grass have a thick, dark A1 horizon, whereas, soils that formed under forests have a pronounced 0 horizon and either a thin, weakly developed A1 horizon or a leached, light colored A2 horizon.

The three broad vegetative associations in Stevens County are grassland, grassland and woodland, and woodland. Soils that formed under grass, such as Bong, Hunters, Konner, and Stevens soils, have a dark gray, dark grayish brown, or grayish brown A horizon that ranges from 15 to 20 inches in thickness. Grassland vegetation produces good soil structure, which promotes permeability and aids the movement of water, air, and roots through the soil. Soils that formed under mixed grasses and trees, such as Cedonia, Hagen, Raisio, and Spokane soils, have properties that are between those of the grassland and woodland soils. For example, the A horizon is thinner and lighter colored than in grassland soils. The A horizon is typically grayish brown, light brownish gray, or pale brown and ranges from 5 to 10 inches in thickness. Soils that formed under frees that have a sparse understory vegetation, such as Hartill, Moscow, and Waits soils, have a very thin, leached A2 horizon. In these soils, the A2 horizon may not be present if the soils are disturbed.

Soil horizons are often destroyed or mixed by plants and animals. Under natural forest succession, trees die in place or are blown down. Both processes move or displace a considerable volume of soil. Burrowing animals, earthworms, and ants move and sort soil material. Field studies have shown that the A1 horizon in some forest soils are the result of earthworm activity. Ants are credited with producing a sandy sure ace horizon. For the most part, biological processes produce morphological features in the soils that are beneficial.

Man clearly influences soil formation and soil properties. By cultivating crops, man physically alters the surface layer, plow layer, or Ap horizon and increases or depletes the fertility of virgin soils. When he incorporates organic matter and other soil amendments, man changes basic chemical properties, such as pH, base saturation, and nutrients status. Other soil properties altered by man include soil color, structure, and permeability. During logging operations, surface litter and duff are mixed with the mineral surface layer. Clear cutting allows grasses and shrubs to invade and grow. These activities favor the development of a dark A horizon; whereas, under forest, a light colored A2 horizon develops. Cultivation and logging on sloping soils can accelerate erosion on convex areas and, in turn, increase deposition in concave lower areas.

climate

Climate is effective in the formation of soils in Stevens County. The amount and kind of precipitation, seasonal distribution, growing season, and other related factors largely determine the types of vegetation that are grown, the volume of organic matter returned to the soil, and the way that organic matter is accumulated it the soil.

Moisture and temperature regimes control the rate of soil forming processes, such as weathering; control the release of mineral constituents; and control the translocation of weathering products. Effects of climate are marked by the presence and the degree of development of the horizons and by the properties of horizons that are used to characterize and classify the soils in the county.

Winters in Stevens County are long and cold. Snow usually covers the ground from early in December until early in March. The average winter temperature is about 28° F. Cold air from the north enters the area through major north-south trending valleys. Minor east-west trending valleys, beginning in the mountains, are colder than the surrounding foothills because of cold air drainage from the high country. During winter, warm, moist air often enters from the west and produces low clouds and fog. These climatic factors interact to lower soil temperatures and increase the effectiveness of soil moisture by slowing evapotranspiration in the early part of the growing season.

Summers are sunny, hot, and dry. Continental air causes high temperatures and low relative humidity. The average summer temperature is 65° F. Occasionally, an eastward-moving cold air mass causes summer thunderstorms, especially in the mountains.

Annual precipitation ranges from 15 to 20 inches in the valleys and southern part of the county and from 20 to 45 inches in the mountains. Precipitation is lowest during July and August. It increases gradually to a maximum in December and January, decreases late in winter and spring, and then increases again in June. During winter most of the precipitation is snow, but occasionally there are periods when rain and warm wind occur at mid elevations and below.

Generally, summer rainfall is ineffective, but occasional summer storms can be intense although usually of short duration. Precipitation is rarely adequate during the summer to replenish the soil moisture. Early in July, low humidity and high temperatures causes rapid evapotranspiration. As a result, most soils in Stevens County are dry from July to October. During this period, temperatures are optimum for chemical and biological activity; but because the soils are dry, soil forming processes are arrested. Late in spring, when soil moisture is optimum for chemical and biological soil forming processes, the soil is cool. The coolness of the soil results in a slow rate of weathering and organic matter decomposition but a very effective leaching process. Many of the soils in Stevens County have properties that reflect this kind of climatic influence on soil development.

In the warmer areas, where the annual precipitation ranges from 15 to 18 inches per year, the soils have a thick, dark A1 horizon, a pH of 6.5, and are more than 75 percent base saturation. The Stevens soils are an example. These soils formed under grassland vegetation. They are relatively unweathered and have few morphologic properties that indicate translocation, other than the removal of lime from the upper part of the soil.

In cooler, wetter areas that are forested, the soils exhibit a higher degree of weathering and have horizons that formed by eluviation and illuviation. In these areas the annual precipitation ranges from 25 to 40 inches, and the frost-free period ranges from 70 to 90 days. The Huckleberry and Vassar soils are examples. These soils are characterized by distinct A2 and B2 horizons. The A2 eluviated horizon is gray and medium acid or slightly acid. The B2 horizon is brown and reddish brown as a result of accumulated iron and organic compounds.

Soils at intermediate elevations under drier forests and those in forest-grassland transitions have properties between the extremes. Genetic horizons that reflect these influences are the A1, A2, and B2 horizons. In the transition from dry to moist and from warm to cool, the A1 horizon becomes thinner, more acid, and less dark. The A2 and B2 horizons are intermittent at the beginning of the transition. They become prominent only at higher elevations.

relief

In this survey area, relief influences the formation of the soil directly by modifying the effects of climate on soil moisture and temperature regimes. Runoff, ponding, and frost pockets are examples of climatic modifications that are common in Stevens County. Topography indirectly influences the accumulation and layering of airborne soil forming materials, such as loess and volcanic ash. Slope is a factor in the rate of surface removal and redeposition. The soils in this county have characteristics attributable to these kinds of influences.

Hardesty soils formed in locally eroded materials that have been redeposited in low positions. These soils are a good example of the influence of relief on the accumulation of parent materials, and its influence in modifying soil moisture and temperature regimes. Hardesty soils developed in a relatively dry climatic zone, yet they are mottled to a depth of 15 inches Soils on the surrounding slopes have a surface layer or admixture of thin ash and loess, although they formed n deep deposits of loess and ash in an alluvial position.

The influence of shape of the surface on accumulation and layering of parent materials is illustrated if the Manley and Newbell soils are compared. Manley soils formed on northern exposures above an elevation of 4,500 feet on concave slopes. Newbell soils formed on convex slopes at lower elevations. The Manley soils have a surface layer of volcanic ash that is more than 14 inches thick; whereas, the Newbell soils have an ash layer that is less than 14 inches thick.

Differences in exposure to the sun and wind cause correspondingly different vegetative patterns, which are reflected in the properties of soils within short distances. For example, because south-facing slopes receive more direct radiation than north-facing slopes, they are warmer and drier. Stevens soils are grassland soils that formed on warm, dry southern exposures. They have a thick, dark surface layer. Newbell and Aits soils are forested soils that formed on northern exposures. These soils have a thin, light colored surface layer.

The effect of exposure is also evident at high elevations where the climate is cool and moist. Conifers grow on both northern and southern exposures. In spring, snow remains on northern exposures several weeks longer than on the southern exposures, and the rate of evaporation is lower on the northern exposures. As a result, soil moisture is more effective in translocating carbonates, iron, and aluminum oxides and in the decomposition of products from organic litter. Manley soils are on northern exposures and have an acid, leached surface layer and a bright colored subsoil. Newbell soils are generally on the warmer southern exposures. These soils have a less acid, thinner, leached surface layer and a duller color.

time

The influence of time on the development of soils from parent materials is usually determined by the degree to which soil properties are expressed, such as horizon differentiation and the translocation and accumulation of iron, humus, and clay.

By most standards, the soils of Stevens County are considered young or immature. They exhibit little genetic horizon differentiation. On most soils, time has been sufficient for the organic matter cycle to produce an A horizon and carbonates have been released by chemical weathering and have been translocated. Few soils, however, are characterized by horizons that formed by eluviation-illuviation of iron, humus, and clay.

On the glaciated areas of Stevens County, soil material has been exposed to soil-forming processes for a relatively short time. The maximum length of time, as suggested by fallout patterns from Glacier Peak, is about 12,500 years ago. However, reworked loess and volcanic ash and loessial ash from drier areas outside the county have been incoming during recent times. Mazama ash, estimated at 6,600 years old, forms a distinctive cap over the more protected foothills and mountains and probably makes up a large part of the surface horizon of soils in lower positions.

Because soils along streams periodically receive deposits from uplands, this soil material is now forming on a depositional surface. Soils forming in this material have no perceptible horizons other than layers or a weakly developed A horizon. Bridgeson and Chamokane soils, which are considered to be young or immature, are in these positions. They have dark surface layers that are inherited from the material eroded from the A horizon of surrounding foothills and mountains.

Dearyton and Hodgson soils are the oldest soils in the county in horizon development. These soils have a textural B2t horizon that is characterized by clay films on ped faces and in pores. In addition, both soils have a light gray A2 horizon above the B2t horizon. The Hodgson soils formed in a rainfall zone ranging from 16 to 20 inches. They have an accumulation of calcium carbonate in the C horizon; whereas, the Dearyton soils, which formed in a rainfall zone ranging from 20 to 23 inches, are slightly acid in the upper horizons and have no calcium carbonate in the C horizon.

Bisbee and Marble soils, which formed in sandy, windblown material on old outwash terraces, have an A1 horizon that has been darkened by organic matter, but they have no B horizon. Although these soils are comparable to the older soils in the county in their ages, they are considered to be young because their characteristics are practically the same as this parent material. These immature soils have been exposed to soil-forming processes for a relatively short time.

The effects of time on grassland and forested soils is apparent when these soils are compared with soils that formed in similar material, such as volcanic ash over glacial deposits. In the grassland areas, Stevens, Garrison, Hunters, and Republic soils have a thick, dark A horizon. The B horizon is distinct, and lime has accumulated on the underside of gravel or in lower horizons. In the forested areas, the Newbell, Manley, and Aits soils have had sufficient time to develop recognizable A2 and B2 horizons that are typical of forested soils. These horizons show the effects of eluviation and illuviation of iron, aluminum, and organic matter.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called pods. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, *it* inches, in a 60-inch profile or to a limiting layer is expressed as

	Inches
Very low	0 to 2
Low	2 to 3.75
Moderate	3.75 to 5
High	5 to 7.5
Very high	More than 7.5

Basal area. The cross-sectional area of a tree bole measured at 4 112 feet above ground level. It is usually expressed in square feet of cross-sectional area per acre.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most systems involve a drum, pole, and wire cables using the same principle as that of a rod and reel for fishing. Generally, felled trees are yarded or reeled in with one end lifted or completely suspended to reduce friction and soil disturbance.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carbonates. Indicates effervescence with dilute (about 0.1 normal) HCL (relative amount).

ve-Very slightly effervescent. Few bubbles are observed.

e-Slightly effervescent. Bubbles are readily observed.

es-Strongly effervescent. Bubbles form low foam.

ev-Violently effervescent. Thick foam "jumps" up.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

CMAI (cumulative mean annual increment). The age or rotation at which growing stock of a forest produces the greatest annual growth (for that time period). It is the age at which periodic annual growth and mean annual growth are equal.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are

Loose. -Noncoherent when dry or moist; does not hold together in a mass.

Friable.-When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.-When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.-When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.-When dry, breaks into powder or individual grains under very slight pressure.

Cemented.-Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dbh (diameter at breast height). The diameter of a tree at 4.5 feet above the ground level on the uphill side.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.-Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained. -Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.-Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons.

Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.-Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.-Water is removed slowly enough that the soil is wet for: significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.-Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.-Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slopes. A sloping surface made by excavating soil material from the road cut. It is usually on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, and clay.

Firebreaks. Spaces cleared of flammable material to stop or check creeping or running fires. These spaces also serve as a line from which to work and to facilitate the movement of men and equipment in fire suppression. Designated roads also serve as firebreaks.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristic: produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.-An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.-The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.-Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. The most commonly used method of irrigation in Stevens County is *sprinkler*-in which water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mean annual increment. The average yearly volume growth of a stand of trees from the year of origin to the age under consideration.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance-few, *common,* and *many, size-fine, medium,* and *coarse;* and contrast-faint, *distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Pebble. An individual rounded or angular rock fragment up to 3 inches in diameter.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0 06 inch
Slow	0.06 to 0 20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 2C inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential natural plant community. The total plant community that is best adapted to the combination of environmental factors and is in dynamic equilibrium with the environment.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Reforestation. Tree seedlings that are planted or become naturally established on an area of land that was once forested. This term also applies to the planting of seedlings.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth rapping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Road cut. A sloping surface made by mechanical means during road construction. It is usually or the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders..

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff.. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from ;oft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of *very* fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Skid trails. The paths left from skidded logs and the bulldozer or tractor used to pull them.

Skidding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most systems involve pulling the trees with wire cables attached to a bulldozer or rubber-tired tractor. Generally, felled trees are skidded or pulled with one end lifted to reduce friction and soil disturbance.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil compaction. An alteration of soil structure that ultimately can affect the biological and chemical properties. Soil compaction decreases voids and increases bulk density.

Soil puddling. This condition occurs in certain soils when they are wet. Exertion of mechanical force destroys the soil structure by compression and shearing and results in the rearrangement of the soil particles to a massive or nonstructural state. This exertion generally accompanies the compaction process.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.013 to 0.002
Clay	less tan 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stand density. The degree to which an area is covered with living trees. It is usually expressed in units of basal area per acre, number of trees per acre, or the percentage of ground covered by the tree canopy as viewed from above.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary ::soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless soils* are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth in nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. Trees that are uprooted and tipped over by the wind.

Yarding paths. The paths left from cable-yarded logs as they are pulled uphill or downhill to a nearby central area.

Yield (woodland). The volume of wood fiber from harvested trees taken from a certain unit of area. It is usually measured in board-feet or cubic-feet per acre.